DataDirect™
NETWORKS

EF2800

Fibre Channel RAID System

User Guide

DataDirect Networks

EF2800

Fibre Channel RAID Storage System

User Guide

CE

V 1.0

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Preface

What is in this Guide

This user guide gives you step-by-step instructions on how to install, configure and connect the EF2800 storage subsystem to your host computer system, and how to use and maintain the system.

Who should use this Guide

This user guide assumes that you have a working knowledge of the Fibre Channel environment into which you are installing the EF2800 system. If you do not have these skills, or are not confident with the instructions in this guide, do not proceed with the installation.

International Standards

The EF2800 storage system complies with the requirements of the following agencies and standards:

- CE to IEC 950/EN60950
- UL 60950
- cUL

Potential for Radio Frequency Interference

USA Federal Communications Commission (FCC)

NOTE : *This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. The supplier is not responsible for any radio or television interference caused by using other than

recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: *FCC approval only applies when using the supplied screened Ethernet cable.*

European Regulations

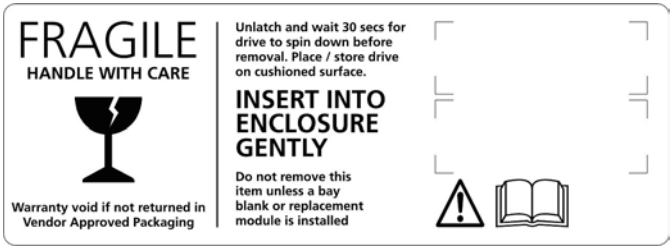
This equipment complies with European Regulations EN 55022 Class A: Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipments and EN50082-1: Generic Immunity.

Safety

All plug-in modules are part of the fire enclosure and must only be removed when a replacement can be immediately added. The system must not be run without all units in place.

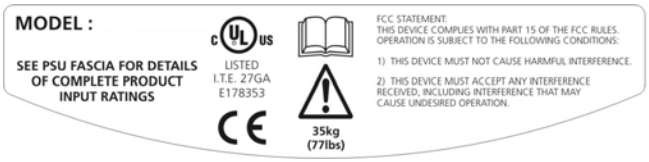
Permanently unplug the unit if you think that it has become damaged in any way and before you move it.

Drive Carrier Module Caution Label:


FRAGILE
HANDLE WITH CARE
Warranty void if not returned in Vendor Approved Packaging
Unlatch and wait 30 secs for drive to spin down before removal. Place / store drive on cushioned surface.
INSERT INTO ENCLOSURE GENTLY
Do not remove this item unless a bay blank or replacement module is installed

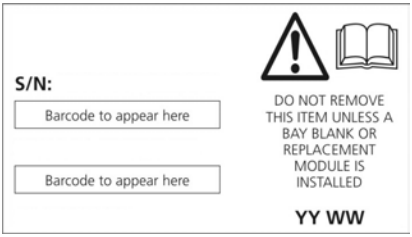
- Do not operate with modules missing
- Spin down time 30 seconds

Chassis Warning Label: Weight Hazard


MODEL :
SEE PSU FASCIA FOR DETAILS OF COMPLETE PRODUCT INPUT RATINGS
LISTED
I.T.E. 27GA
E178353
35kg
(77lbs)
FCC STATEMENT:
THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING CONDITIONS:
1) THIS DEVICE MUST NOT CAUSE HARMFUL INTERFERENCE.
2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

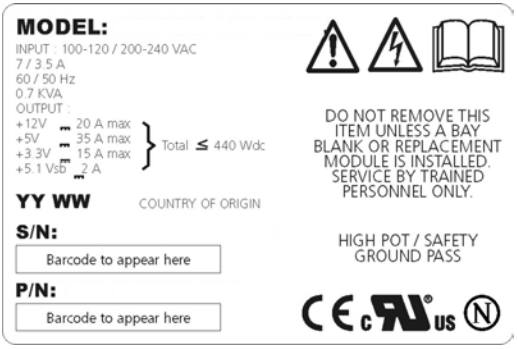
- An EF2800 enclosure can weigh up to 37kg (81lb). Do not try to lift it by yourself.
- Do not attempt to lift the enclosure by means of the extended LRC module or by the handles on the PSU/Cooling module as they are not designed to support the weight of the populated enclosure.

Controller Module Caution Label: Do not operate with modules missing


S/N:
Barcode to appear here
Barcode to appear here
DO NOT REMOVE THIS ITEM UNLESS A BAY BLANK OR REPLACEMENT MODULE IS INSTALLED
YY WW

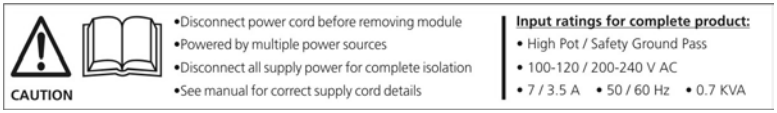
- In order to comply with applicable safety, emission and thermal requirements no covers should be removed and all bays must be fitted with plug-in modules.

PSU/Cooling Module Caution Label: Do not operate with modules missing


MODEL:
INPUT : 100-120 / 200-240 VAC
7 / 3.5 A
60 / 50 Hz
0.7 KVA
OUTPUT :
+12V 20 A max
+5V 35 A max
+3.3V 15 A max
+5.1 Vsb 2 A
Total ≤ 440 Wdc
YY WW
COUNTRY OF ORIGIN
S/N:
Barcode to appear here
P/N:
Barcode to appear here
DO NOT REMOVE THIS ITEM UNLESS A BAY BLANK OR REPLACEMENT MODULE IS INSTALLED. SERVICE BY TRAINED PERSONNEL ONLY.
HIGH POT / SAFETY GROUND PASS

- The EF2800 unit must only be operated from a power supply input voltage range of 100 - 120 VAC or 200-240 VAC.
- The plug on the power supply cord is used as the main disconnect device. Ensure that the socket outlets are located near the equipment and are easily accessible.
- The equipment is intended to operate with two working PSUs.
- If powered by multiple AC sources, disconnect all supply power for complete isolation.

PSU Warning Label: Power Hazards


CAUTION
•Disconnect power cord before removing module
•Powered by multiple power sources
•Disconnect all supply power for complete isolation
•See manual for correct supply cord details
Input ratings for complete product:
• High Pot / Safety Ground Pass
• 100-120 / 200-240 V AC
• 7 / 3.5 A • 50 / 60 Hz • 0.7 KVA

- The power connection should always be disconnected prior to removal of the Power Supply/Cooling module from the enclosure.
- A safe electrical earth connection must be provided to the power cord. Check the grounding of the enclosure before applying power.
- Provide a suitable power source with electrical overload protection to meet the requirements laid down in the technical specification.
- A faulty Power Supply/Cooling module must be replaced with a fully operational module within 24 hours.

Warning ! Do not remove covers from the PSU. Danger of electric shock inside. Return the PSU to your supplier for repair.

PSU Safety Label: Electric Shock Hazard Inside

Caution ! If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Battery Safety

The battery is user replaceable, please refer to the Battery Replacement Procedure.

Warning ! There is a danger of explosion if the battery is incorrectly replaced.

- Dispose of used batteries in accordance with the manufacturer's instructions and National regulations.

Laser Safety

Class 1 Laser Product

When the EF2800 is supplied with optical modules they contain a laser that complies with Laser Class 1, US 21 CFR (J) and EN 60825-1.

If optical modules are to be provided and fitted by the end user, lasers must comply with the standards listed above.

Rack System Precautions

The following safety requirements must be considered when the unit is mounted in a rack.

- The rack design should incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or in normal use.
- When loading a rack with the units, fill the rack from the bottom up and empty from the top down.
- The rack should comply with the airflow requirements detailed in the technical specification.
- The rack design should take into consideration the maximum operating ambient temperature for the unit, which is 40°C when dual cooling modules are fitted.
- The rack should have a safe electrical distribution system. It must provide overcurrent protection for the unit and must not be overloaded by the total number of units installed in the rack.

Consideration of the units nameplate rating should be used when addressing these concerns.

- The electrical distribution system must provide a reliable earth for each unit and the rack.
- Each power supply in each unit has an earth leakage current of 0.65mA. The design of the electrical distribution system must take into consideration the total earth leakage current from all the power supplies in all the units. The rack will require labelling with "HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply".
- The rack when configured with the units must meet the safety requirements of UL 1950 and IEC 60950.

ESD Precautions

Caution ! It is recommended that you fit and check a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling EF2800 plug-in modules and components. Avoid contact with backplane components and module connectors, etc.

Electrical Surges

A powerful electrical surge (2,000 volts), primarily associated with a lightning strike, may cause a Storage Manager (SM) to go offline or restart. You may have to manually put the SM module back online.

Review the event log to determine the SM's status (see section 7.2 on page 108) and take the appropriate action based on its status. For information about restarting an SM, see section 4.3.1 on page 62. For information about putting an SM online, see section 4.3.4 on page 64.

Tests show that electrical surges up to 2,000 volts coming through the AC connection will not damage the SM hardware.

Data Security

- Power down your host computer and all attached peripheral devices before beginning installation.
- Each enclosure contains up to 16 removable disk drive modules. Disk units are fragile. Handle them with care, and keep them away from strong magnetic fields.
- *All* the supplied plug-in modules and blanking plates must be in place for the air to flow correctly around the enclosure and also to complete the internal circuitry.
- If the enclosure is used with modules or blanking plates missing for more than a few minutes, the enclosure can overheat, causing power failure and data loss. Such use may also invalidate the warranty.
- If you remove any drive module, you may lose data.
  - If you remove a drive module, replace it immediately. If it is faulty, replace it with a drive module of the same type and capacity
- Ensure that all disk drives are removed from the enclosure before attempting to manhandle or move the rack installation.
- Do not abandon your backup routines. No system is completely foolproof.

Special Tools and Equipment

There are no special tools required but in order to complete the assembly of some configurations you may need the following:

- Security keys (one of these should be included with your EF2800 enclosure for use with the drive locks).

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1

Introduction

The DataDirect Networks EF2800 system is designed as a RAID Subsystem to be used with a host system or Storage Area Network (SAN) with a Fibre Channel (FC) connection and FC disk drives to provide a powerful storage Subsystem.

The EF2800 storage Subsystem is a fault-tolerant RAID systems that lets you configure FC disk drives as fault-tolerant arrays. The arrays are presented as logical units to one or two host ports. The EF2800s have write-back cache memory that is backed up by a battery in each EF2800 Storage Manager (SM) module.

The EF2800 systems have two fully redundant FC host ports on each SM module that support 1-Gbit and 2-Gbit speeds and four fully redundant FC disk ports.

Figure 1. EF2800 System Front View

The EF2800 includes the following features:

- Fully fault-tolerant, modular design
- Sequential data transfers from disk arrays at nearly 700 MB/sec sustained
- Greater than 50,000 I/O operations per second (IOPS) capability
- Operating system independent, no special software or drivers required
- Two 1-Gbit/2-Gbit Fibre Channel host ports on each LRC I/O module.
- Fibre Channel host interface supporting Fibre Channel-Arbitrated Loop (FC-AL), point-to-point, and switched fabric
- Four redundant 1-Gbit/2-Gbit FC disk ports
- Support for up to 248 FC devices organized in up to 32 arrays, with 16 partitions per array up to a total of 128 Logical Unit Numbers (LUNs)
- Configuration and management using a local area network (LAN) (10/100baseT) connection
- Support for 512Mb or 1024Mb cache memory on each LRC I/O module using standard double data rate (DDR; DDR 266 supported) Dual Inline Memory Modules (DIMMs). DIMMs must be qualified.
- Redundant power, AC, and cooling
- Built to fit into 3U-high (5.25" [13.35 cm]), 19" (48.26 cm) rack
- Support for RAID levels 0, 1, 3, 4, 5, 10, 50, and just a bunch of disks (JBOD)
- Online capacity expansion allowing reconfiguration without interruptions
- Advanced disk drive utilities, array verification and recovery, and global spares
- Embedded Configuration Application Programming Interface (CAPI) for programmatic configuration and management of the EF2800
- Replacement of major system modules during online operation

- Software upgrades either in-band over FC or out-of-band using RS-232 or Ethernet
- Continuous runtime monitoring for warnings for out-of-spec CPU temperatures, controller voltages, battery failures, fan failures, and internal errors

1.1 The Enclosure Core Product

The EF2800 design concept is based on a subsystem together with a set of plug-in modules. The EF2800 enclosure as supplied comprises:

- Chassis and backplane with integral Operators Panel
- Power Supply/Cooling plug-in modules, auto-ranging, 475W, AC
- FC-AL Drive Carrier Modules and associated dummy carrier modules
- FC-AL LRC 2Gb/s Input/Output Modules with integrated RAID controllers, known as Storage Managers

Figure 1 and Figure 2 show the front and rear views of an EF2800 enclosure respectively.

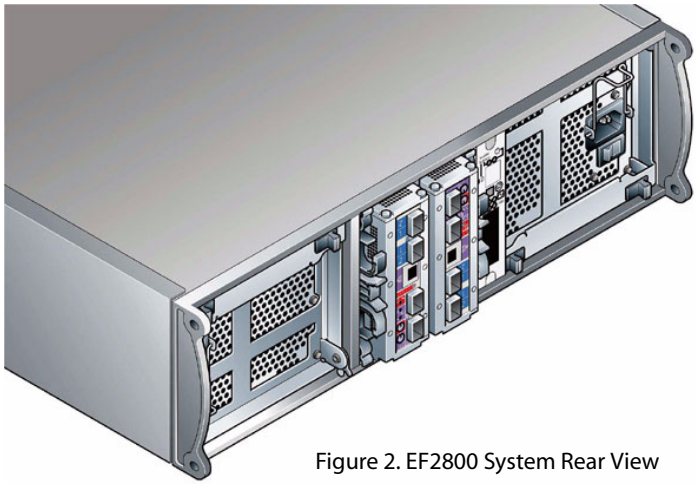
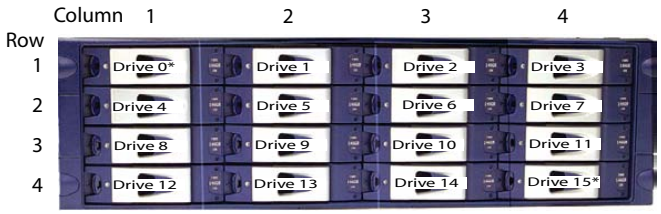


Figure 2. EF2800 System Rear View

1.1.1 Enclosure Chassis

The chassis consists of a sheet metal enclosure assembly containing a backplane PCB and module runner system. This chassis assembly also includes an integral Operators (Ops) Panel mounted at the rear.

The chassis assembly contains 16 drive bays at the front, each of which accommodates a plug-in drive carrier module (Figure 3). The 16 drive bays are arranged in 4 rows of 4 drives. Bay numbers are defined by column/row.



*SES Drives (there must be a drive present in Bays 1/1 and 4/4 to enable SES communications to operate)

Figure 3. Drive Locations at the Front

At the rear, there are 5 module bays to house two power supply/cooling modules, two LRC I/O modules and the integral Ops panel (Figure 4). The Backplane PCB provides logic level signal and low voltage power distribution paths.

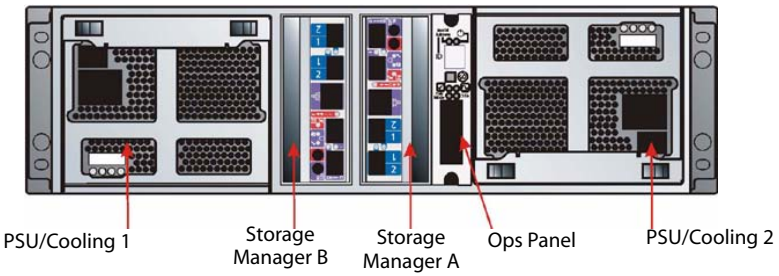


Figure 4. Module Locations at Rear

The 4 × 4 chassis is fitted with 19 inch Rack mounting features which enables it to be fitted to standard 19 inch racks and uses 3EIA units of rack space.

1.2 The Plug-in Modules

An EF2800 Enclosure requires one or more of the following modules for normal operation.

1.2.1 Power Supply/Cooling Module

The EF2800 enclosure utilizes two Power Supply/Cooling modules (Figure 5). PSU (power supply unit) voltage operating ranges are nominally 115V or 230V AC, selected automatically.

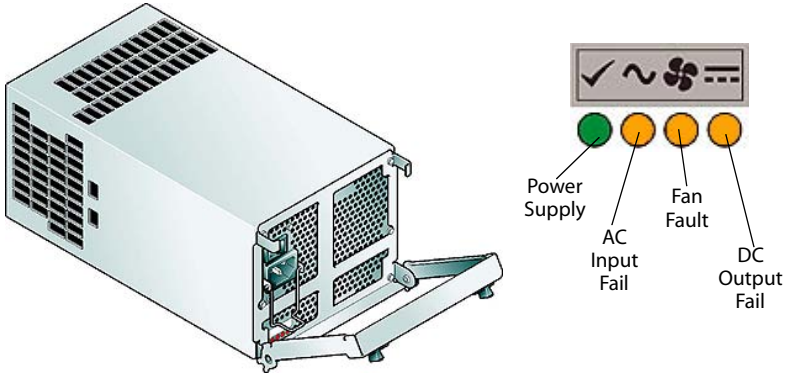


Figure 5. Power Supply/Cooling Module and LEDs

Four LEDs mounted on the front panel of the Power Supply/Cooling Module indicate the status of the PSU and the fans.

The EF2800 system must always be operated with two power supply/cooling modules installed. The two modules operate together so that if one fails the other maintains the power supply and cooling while you replace the faulty unit. The faulty module will still be providing cooling for the system so do not remove it until a replacement is available for fitting.

Module replacement should only take a few minutes to perform but must be completed within 5 minutes from removal of the failed module.

1.2.2 Operators Panel

The Ops Panel (Figure 6) provides the enclosure with a micro controller which is used to monitor and control all elements of the EF2800 enclosure. It is supplied as an integral part of the enclosure.

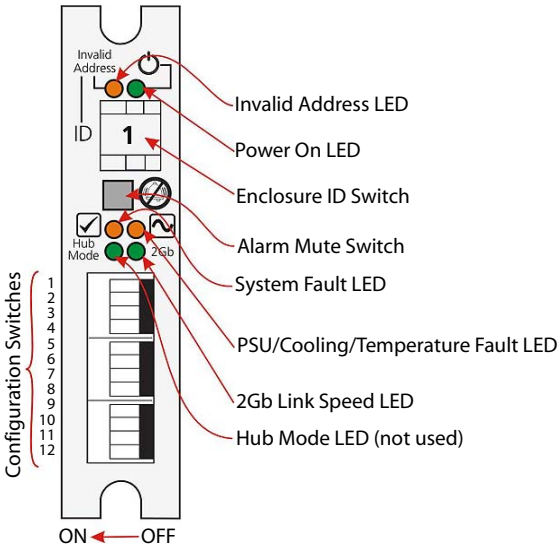


Figure 6. Ops Panel

1.2.2.1 Ops Panel Status LED Indicators and Switches

The Ops Panel includes status LED indicators which show the status for all modules, an Audible Alarm which will be activated when a fault state is present, an Alarm Mute switch, and a thumb wheel SEL_ID address range selector switch (Figure 6).

The Ops Panel configuration switch functions are shown in Figure 7.

NOTE: Switch settings are only read at Power On. The EF2800 enclosure ID must always be set to select ID1.

CAUTION: All mandatory settings must be observed in order for the EF2800 system to function correctly.

Figure 7. Ops Panel Switch Functions *(Default settings for usage at 2Gb/s)*

Switch No.	Function	Recommended Setting		Definition
1	Loop Select, Dual (2x8)	Off		LRC operates on two loops of 8 drives (Mandatory)
2	Not Used	Note: on expansion enclosures this must be set On.		
3	Not Used			
4	Not Used			
5 & 6	Not Used			
7 & 8	Drive Loop Speed Select	Sw7	Sw8	
		On	Off	Force 2Gb/s
		Off	Off	Force 1Gb/s
9 & 10	Drive Addressing Mode Selection	Sw9	Sw10	
		On	Off	Mode 2, 2x8 mode. (Mandatory)
11	SOFT SELECT	On		Select Functions using the hardware switches
12	Not Used			

NOTE: To set Host 1Gb use the Ethernet connected configurator.

1.2.3 LRCI/O Module (FC-AL)

The EF2800 enclosure includes two Loop Resiliency Circuit (LRC) I/O modules with integrated RAID controller, known as Storage Managers (SM) modules (Figure 8). The FC-AL backplane incorporates two independent loops formed by Port Bypass Circuits within the LRC I/O modules.

The plug-in SM modules have been designed for integration into an EF2800 system, utilizing FC-AL interfacing with the host computer system.

Processors housed on the I/O modules provide enclosure management and interface to devices on the backplane, PSU, LRC, and Ops Panel, to

monitor internal functions. These processors operate in a master slave configuration to allow failover.

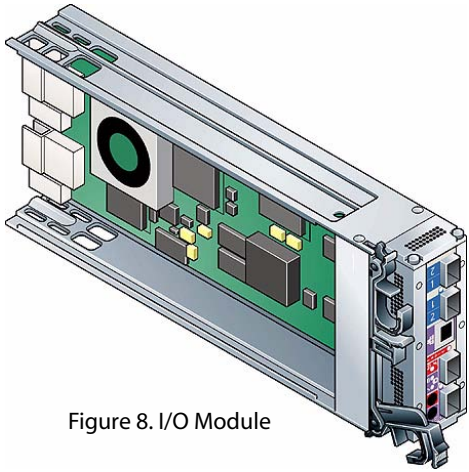


Figure 8. I/O Module

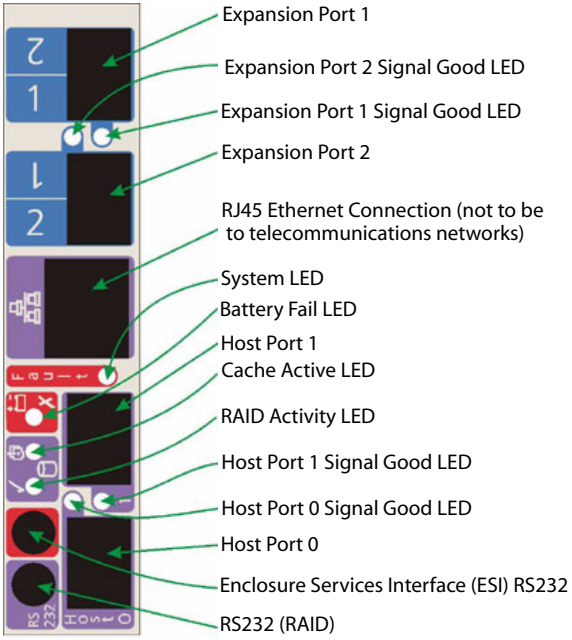

Expansion Port 1
Expansion Port 2 Signal Good LED
Expansion Port 1 Signal Good LED
Expansion Port 2
RJ45 Ethernet Connection (not to be to telecommunications networks)
System LED
Battery Fail LED
Host Port 1
Cache Active LED
RAID Activity LED
Host Port 1 Signal Good LED
Host Port 0 Signal Good LED
Host Port 0
Enclosure Services Interface (ESI) RS232
RS232 (RAID)

Figure 9. Connectors and LEDs on I/O Module

The module incorporates the following status LED indicators (Figure 9):

- Expansion Port 1 Rx Good (Green)
- Expansion Port 0 Rx Good (Green)
- System Ready (Green)
- Battery Fault (Amber)
- Cache Active (Green)
- RAID Controller Activity
- Host Port 1 Signal Good (Green)
- Host Port 0 Signal Good (Green)

NOTE: Fitting of a RAID controller to the LRC module is a factory only operation.

Do not attempt to lift the enclosure by means of the extended I/O module.

The Storage Manager module operates at 1 or 2 Gb.

Two external ports for expansion to further enclosures are provided by SFP connectors. Two external ports to the host controllers are provided from Small Form Factor (SFP) GBIC modules, auto-bypass at the output ports is also provided.

An RJ45 10/100 Base T Ethernet controller management port is provided on the LRC board, interfacing to the controller through 2 RS232 serial and GPIO lines.

CAUTION: The RJ45 Ethernet connector on the LRC module must not be connected to telecommunications networks.

The SM module also incorporates a standby Li-ion battery pack, 72 hours cache hold up time (512Mb). The battery cell has thermal protection. Battery cells cannot be replaced in the field.

1.2.4 Drive Carrier Module

The Drive Carrier module comprises a hard disk mounted in a carrier. Each drive bay will house a single 1.0-inch high, 3.5-inch disk drive in its carrier (Figure 10).

Each disk drive is enclosed in a die-cast aluminum carrier which provides excellent thermal conduction, radio frequency and electro-magnetic induction protection and affords the drive maximum physical protection.

The front cap also supports an ergonomic handle which provides the following functions:

- Camming of carrier into and out of drive bays
- Positive “spring loading” of the drive/backplane connector
- An anti-tamper lock operated by a torx socket type key

Figure 10. Drive Carrier Module

1.2.4.1 Drive Status LED Indicators

Each drive module incorporates two LED indicators, a Status (green) LED and a Fault (amber) LED (Figure 10). In normal operation the Status LED will be ON and will flash as the drive operates. The Fault LED will be on if the drive fails.

1.2.4.2 Anti-Tamper Locks

Anti-tamper locks are fitted in the drive carrier handles (Figure 11). The lock can be accessed through the small cutout in the latch section of the handle, using a T10 Security Torx type bit. These locks are provided to disable the normal “pinch” latch action of the carrier handle.

NOTE : Do NOT overtighten the anti-tamper lock!

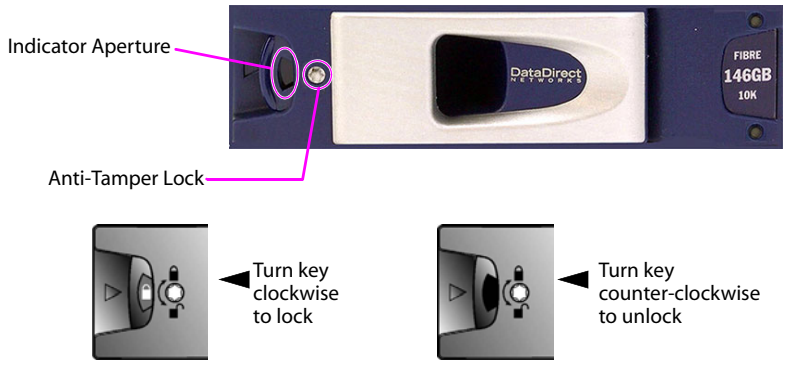


Figure 11. Anti-Tamper Lock on Drive Carrier Module

1.2.5 Dummy Carrier Modules

Dummy carrier modules are provided for fitting in all unused drive bays. They are designed as integral drive module front caps with handles and must be fitted to all unused drive bays to maintain balanced airflow.

Warning

Operation of the Enclosure with *ANY* modules missing will disrupt the airflow and the drives will not receive sufficient cooling. It is *ESSENTIAL* that all apertures are filled before operating the unit. Dummy Carriers are available for this purpose.

1.3 Visible and Audible Alarms

The functional modules have associated status LEDs. The Ops Panel shows a consolidated status for all modules.

LEDs show constant green for good or positive indication. Constant amber LEDs indicate there is a fault present within that module.

The Ops Panel also incorporates an audible alarm to indicate when a fault state is present and also an Alarm Mute push-button.

The Ops Panel is an integral part of the enclosure chassis assembly and can only be replaced by trained personnel.

1.4 Internal Drive Loop Structure

The EF2800 enclosure is configured with two internal loops of 8 drives.

The 16 drive dual loop internal connection structure is shown in Figure 12. Two plug-in, Loop Redundancy Circuit SM modules are mounted in rear Bays 3 and 4 (Figure 4); these contain Port Bypass Circuits (PBC) that provide loop resiliency in the event of unplugged or failing drives.

NOTE: Figure 12 shows the logical routing of the EF2800 FC-AL interface through the drive bays, this figure does not represent the physical wiring of the enclosure.

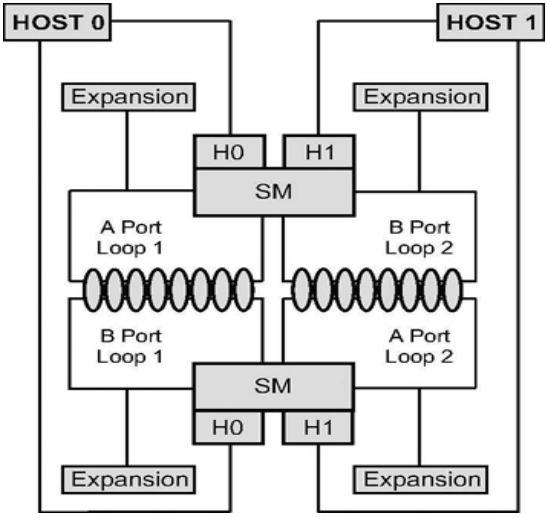


Figure 12. EF2800 Internal Drive Loop Structure

Each FC loop is routed through an independent SM module fitted in the rear of the enclosure. Either of these may be removed while the other is operating, thus providing fully redundant FC operation.

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2

Getting Started

In this chapter, you are shown how to install your EF2800 RAID enclosure (and plug-in modules) into an industry standard 19-inch rack cabinet.

NOTE: The installation, configuration, and use of the EF2800 RAID system in all but the most basic of environments requires certain expertise on the part of the user. Because there are many connections and configuration options involving host platforms, host bus adapters (HBAs), storage enclosures, disk drive devices, and applications, only general guidelines are included in this document. No in-depth discussion of integration of the EF2800 is included here due to the high level of expertise required on the part of the integrator and the level of support that may be needed from your supplier.

Do not operate the EF2800 system until the ambient temperature is within the specified operating range (see Appendix A). If the drives have been recently installed ensure they have had time to acclimatize before operating them.

CAUTION: When connecting up the EF2800 system, use the power cords supplied or ones which match the specification quoted in Section A.1.5.

2.1 Planning Your Installation

Before you begin installation you should become familiar with the configuration requirements of your EF2800 system, detailed in Figure 13. The correct positions of each plug-in modules are shown in Figure 15.

Figure 13. EF2800 Configuration

Module	Location
Drive Bays	ALL drive bays must be filled with either a drive module or a dummy module, no bays should be left completely empty
Power Supply/ Cooling Modules	Two Power Supply/Cooling modules are required. Full power and cooling redundancy is provided while a faulty module is replaced. Install the Power Supply/Cooling modules in rear Bays 1 & 5.
Storage Manager (I/O) Modules	Installed in rear Bays 3 and 4
Ops Panel	Rear Bay 2 (integral part of chassis assembly)

2.1.1 Enclosure Bay Numbering Convention

The enclosure bay numbering conventions are shown in Figure 14 and Figure 15. A Bay is defined as the space required to house a single 1.0" high 3.5 inch disk drive in its carrier module. For example, an 1 × 4 bay module would take the space of 1 drive width by 4 drive bays high.

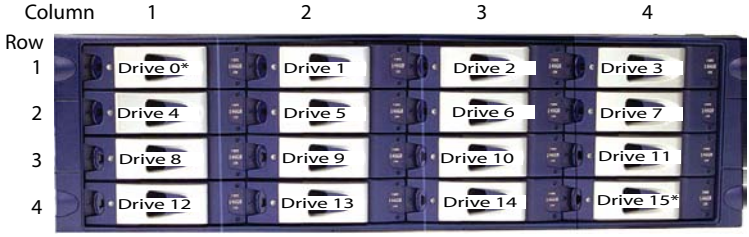

Figure 14. Drive Locations at Front

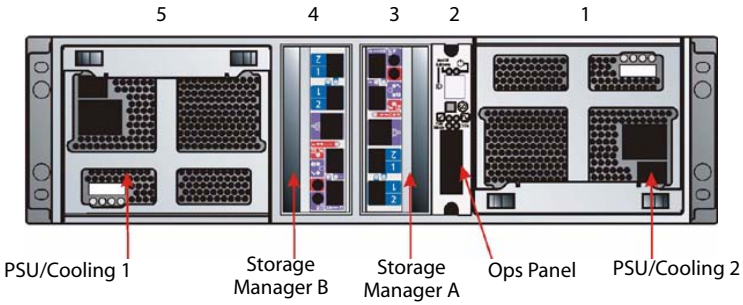

Figure 15. Module Locations at Rear

The EF2800 system is housed in a 4 × 4 enclosure, i.e. 4 bays wide by 4 bays high. The front bays are numbered 1 to 4 from left to right, when viewed from the front, and 1 to 4 from top to bottom. Drive Carrier Module locations are identified from a matrix of the top and side numbers. The rear bays are numbered 1 to 5 from right to left, when viewed from the rear. Module locations are identified by a matrix of the top and side numbers.

NOTE : For proper operation of SES (SCSI Enclosure Services), drive module must always be installed in bays 1/1 (drive 0) and 4/4 (drive 15).

2.2 Rack-Mounting the Enclosure

Warning

Ensure that you have checked and fitted a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling EF2800 modules and components. Avoid contact with backplane components and module connectors.

2.2.1 Pre-Requisites

The EF2800 enclosure is designed for installation into an industry standard 19-inch cabinet capable of holding the unit.

- Minimum depth 20.12" (511mm) from front flange to rear metalwork (excludes rear cabling)

- Weight of up to 81.4lbs (37kg), dependent upon configuration per enclosure
- A minimum gap of 1" (25mm) clearance between the rack cover and front of drawer; and 2" (50mm) rear clearance between rear of drawer and rear of rack is recommended in order to maintain the correct air flow around the enclosure.
- The rack should present a maximum back pressure of 5 Pascals (0.5mm water gauge). A vented rear door or no door at all are the recommended configurations.

2.2.2 Unpacking the EF2800

To unpack the EF2800:

1. Place the shipping container on a flat, clean, stable surface.
2. Carefully remove the EF2800 and verify the contents against the packing list.
3. Remove the foam from the sides of the EF2800 and remove it from the plastic bag.
4. Save the original shipping container and packing materials in case future reshipment is necessary.
5. Visually inspect the EF2800 and notify your freight carrier immediately of any damage.

You can hot swap each module as long as the other module of the pair is operating properly.

CAUTION: Do not leave any slots open on the EF2800 family of products. If you need to replace a module, leave the old module in place until you have the replacement. Leaving a slot open adversely affects the airflow and may cause the unit to overheat.

2.2.3 Installing the Enclosure in Rack

CAUTION: The EF2800 enclosure with all its component parts installed is too heavy for easy installation into a rack cabinet. The following procedures describe the installation of the enclosure and highlights any critical co-requisite requirements and good handling practices which we encourage you to follow so as to ensure that a successful installation is achieved in the easiest manner.

1. Install the two rail/support assemblies in the rack.

   Using three #10 screws, washers, and nuts, assemble the rail inside the support (Figure 16). Only finger-tighten the screws.

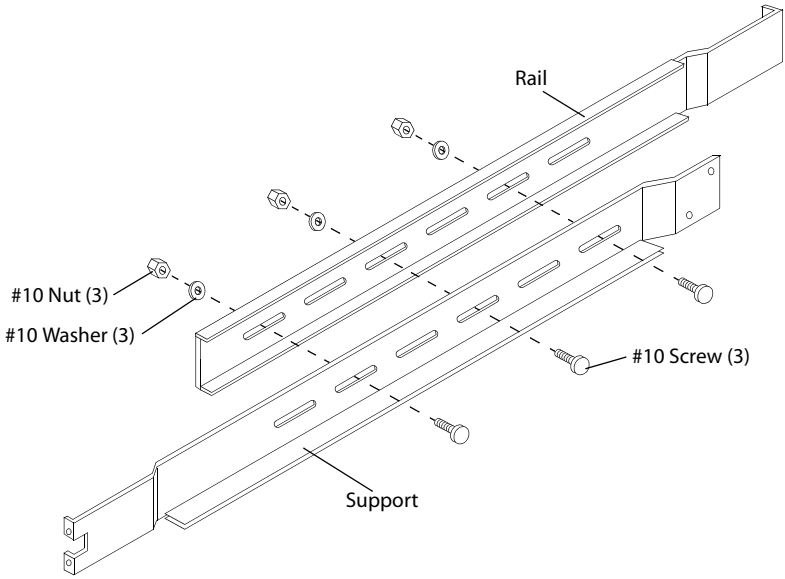

Figure 16. Assembling Rail to Support (Left Hand Assembly)

   Adjust the length of the rail/support assembly to fit the depth of the rack. Then tighten the three screws and nuts on the assembly. Fasten the assembly to the rack frame using four #10 screws, two in front and two in rear (Figure 17). Make sure you leave enough space above the rail/support assembly to accommodate the enclosure. Then tighten all screws.

Similarly, assemble and install the rail/support assembly in the other side of the rack frame, making sure that the two rails are level (horizontally) in the rack.

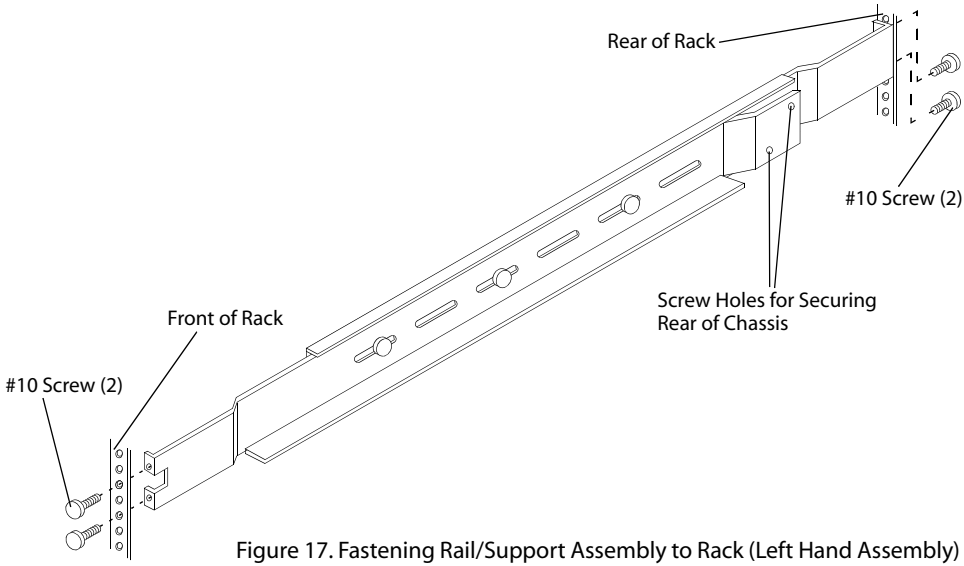

Figure 17. Fastening Rail/Support Assembly to Rack (Left Hand Assembly)

2. To reduce the weight of the unit, it is best to remove the power supplies and drive modules from the enclosures.

To remove a power supply, squeeze the two latches on the handle together and open the handle to cam the module out of the enclosure.

To remove a drive module, press the latch in the handle towards the right to release the handle (Figure 18).

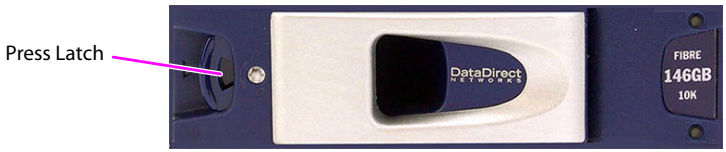

Figure 18. Latch Operation on Drive Module

Then swing open the handle and pull the module out of the bay. If the anti-tamper lock is activated, see Step [5] on page 27 for

information on how to disengage the lock. Dummy modules may be left in the slots.

3. Carefully place the chassis on the two rail/support assemblies and push it all the way into the rack.

   If in doubt about correct orientation, the drive bays (at front) should have their black drive connectors toward the bottom of each bay.

4. Secure the front of the chassis to the rack frame by inserting four #10 screws (two on each side) through the holes in the flanges and into the rack frame.

   Using four #10 screws (two on each side), secure rear of chassis to rail/support assemblies (Figure 17).

5. Replace the two power supplies in the back.

   Insert one module into the left most bay and the other module into the right most bay. Note the orientation of the modules (Figure 19). Swing the handle towards the module to cam the module home. Make sure that the latches are engaged.

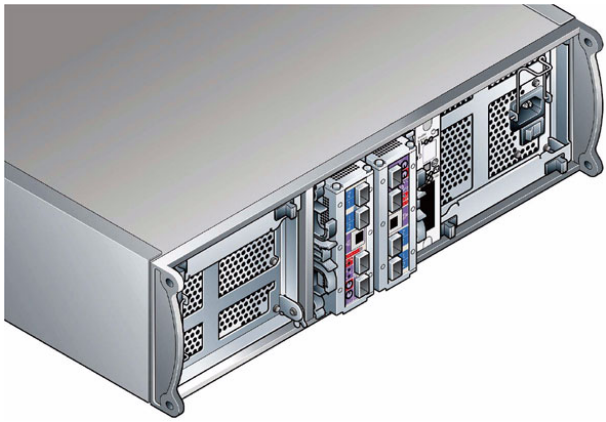

Figure 19. Power Supply Locations in Rear Panel

2.3 Power Supply/Cooling Module Installation

Install in the rear of the enclosure in bays 1 and 5.

Do not remove covers from the Power Supply/Cooling (PSU) module. Danger of electric shock inside. Return the PSU to your supplier for repair.

2.3.1 Parts Check List

- Two Power Supply/Cooling Modules

2.3.2 Procedure

NOTE: PSU2 (RH rear bay) must be fitted "upside-down" as shown in Figure 15.

1. Check for damage, especially to the rear connector on the supply.

CAUTION: Handle the module carefully and avoid damaging the connector pins. Do not install the module if any pins appear to be bent.

2. Squeeze to open both latches and leave the handle in open position (Figure 20).

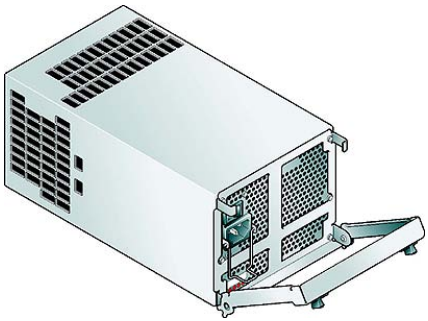

Figure 20. Power Supply Module with Handle in Open Position

3. Slide the module into the enclosure. The modules should be installed in bays 1 and 5, as shown in Figure 21.

NOTE: Install the Power Supply/Cooling module in the right hand bay (Rear Bay 1) of the enclosure in an "upside down" orientation.

Figure 21. Module Locations

4. Cam the module home by manually closing the handle. A click should be heard as the handle latches engage (Figure 22).

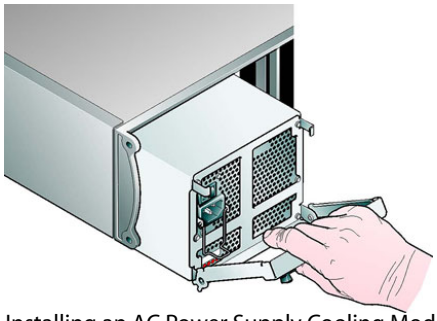

Figure 22. Installing an AC Power Supply Cooling Module

2.4 Controller I/O Module Installation

Warning

Do not attempt to lift the enclosure by means of the extended SM modules.

2.4.1 Parts Check List

- 2 Controller I/O Modules or,
- 1 Controller I/O Module with 1 Blank I/O module

NOTE: The enclosure may be configured with either one or two Controller modules. If only one Controller is fitted it must be installed in rear bay 4 (Controller B location as shown in Figure 15 on page 17) and a Blank I/O module fitted in the unused bay.

2.4.2 Procedure

1. Check for damage especially to the interface connector, do not install if any pins are bent.
2. Squeeze to open the latches (Figure 23).

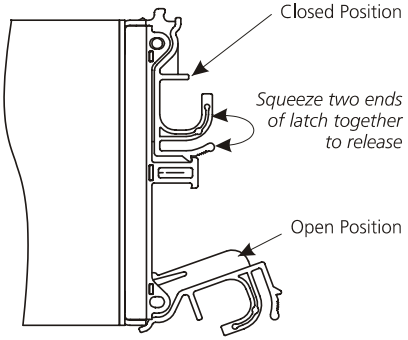

Figure 23. Controller Module Latch Operation

3. Slide the module into the enclosure until the latches engage automatically. The modules should be installed in rear bays 3 and 4 of the enclosure (Figure 24). Note that the LH and RH modules are installed in opposite orientations.

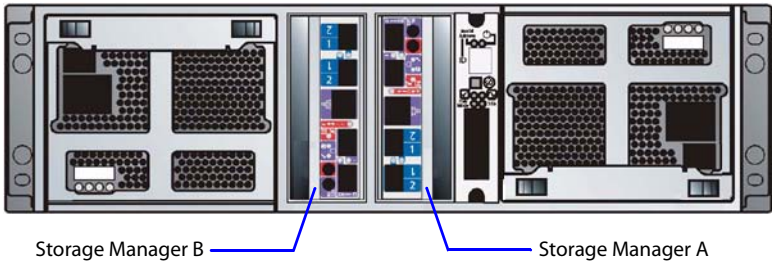

Figure 24. Module Locations

4. Cam the module home by manually closing the latches (Figure 25). A click should be heard as the latches fully engage.

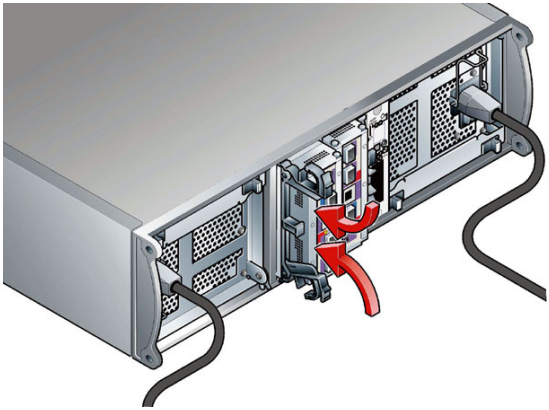

Figure 25. Installing a Controller I/O Module

2.5 Drive Module Installation

Each EF2800 enclosure holds up to 16 drive modules.

The SES (SCSI Enclosure Services) requires disks to be present in bays 1/1 and 4/4 of each enclosure (indicated by shaded background in Figure 26). The drives are not pre-formatted and can be inserted in any order.

NOTE: When planning your system configuration, please remember that all drive bays must be filled with either a drive module or dummy module, no bays should be left completely empty.

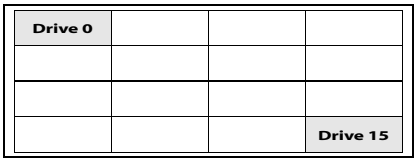

Figure 26. Drive Bays for SES Communication Paths

1. Release the module handle by pressing the latch in the handle towards the right (Figure 27).

   If the anti-tamper lock is activated, see Step [5] below for information on how to disengage the lock.

Figure 27. Opening the Drive Module Handle

2. Insert the module into the bay (Figure 28).

3. Slide the module, gently, all the way into the bay until it is stopped by the camming lever on the right of the module.

4. Cam the module home - the camming foot on the base of the module will engage into a slot on the enclosure. Continue to push firmly until the handle fully engages. A click should be heard as the latch engages and holds the handle closed.

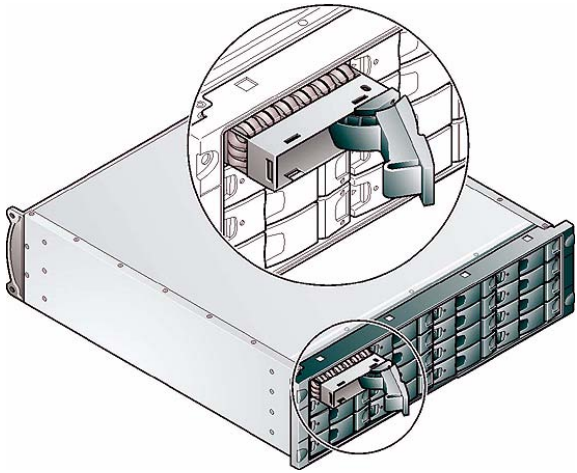

Figure 28. Inserting the Drive Module

5. You may activate the anti-tamper locks on the drive module handles.

   Carefully insert the lock key provided into the cutout in the handle and align it with the socket. Rotate the key in a clockwise direction until the lock indicator is visible in the aperture beside the socket (Figure 29). **Do not over-tighten the anti-tamper lock.**

   To de-activate, rotate the key in a counter-clockwise direction until the lock indicator is no longer visible in the aperture beside the socket.

Figure 29. Activating the Anti-Tamper Lock

2.6 Verify Configuration Switch Settings on Ops Panel

Verify that the settings for the configuration switches on the Ops panel (Figure 30) are the same as listed in Figure 31.

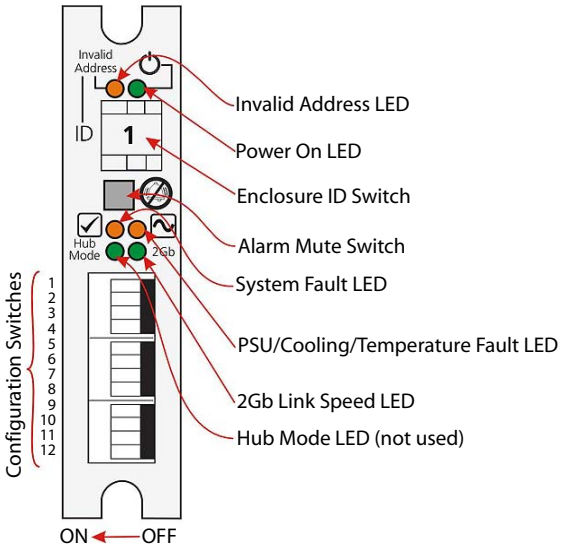

Figure 30. Configuration Switches on Ops Panel

Figure 31. Configuration Switch Settings on Ops Panel

Switch No.	Function	Correct Setting
1	Loop select, Dual (2x8)	Off (mandatory)
2	Not used (Note: This must be set to ON for expansion enclosures.)	
3	Not used	
4	Not used	
5 & 6	Not used	
7 & 8	Drive loop speed select	7 On, 8 Off (Force 2Gb/s)
9 & 10	Drive addressing mode select	9 On, 10 Off (Mode 2)
11	Soft select	On
12	Not used	

2.7 Connecting the Enclosure to FC Host and Disk Ports

The (I/O) interface module provides a Fibre Channel interface via small form-factor pluggable connection (SFPs) that can be either copper HSSDC-2 connectors for copper or optical (LC optical cable) connection. Copper (1M max.) SFP to SFP patch cables are also supported (for enclosure to enclosure connection only).

Each I/O or Loop Resiliency Circuit board houses Port Repeater chips that re-drive the Fibre Channel signals. Each of the LRC I/O boards also houses a number of Port Bypass circuits. The function of these circuits is to bypass the loop connections to empty drive bays or any disk drive which is not operating correctly

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NOTE: There are no external terminators required with Fibre Channel architecture and any drive may be hot plugged during operation.

- You can connect the EF2800 directly to one or more FC HBAs or to a FC switch or hub (Figure 32). Each Storage Manager has two FC host ports.

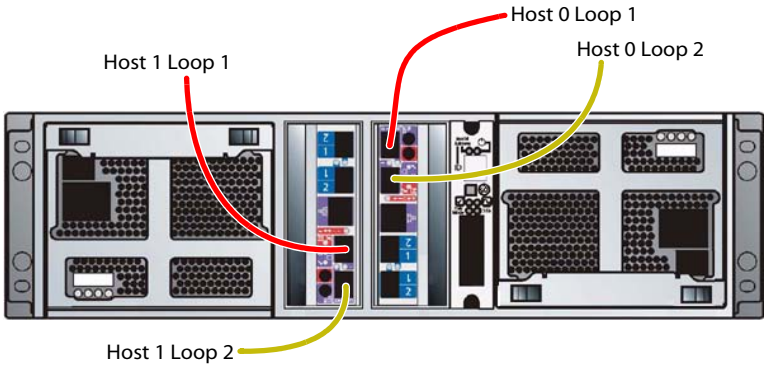

Figure 32. Connecting the EF2400 Enclosure

- You can attach FC disk drives to all of the EF2800's FC disk ports.
- You can connect up to 248 FC devices to the EF2800, including the 16 internal hard drives.

- You must use approved FC components (for example, standard 3.3-volt small form-factor pluggable [SFPs] and FC cable, either optical or copper) that you can purchase from your supplier. The SFP connector is available in two versions: Copper and Optical.
- You can connect additional disk enclosures by daisy-chaining them using the patterns shown in Figure 33.

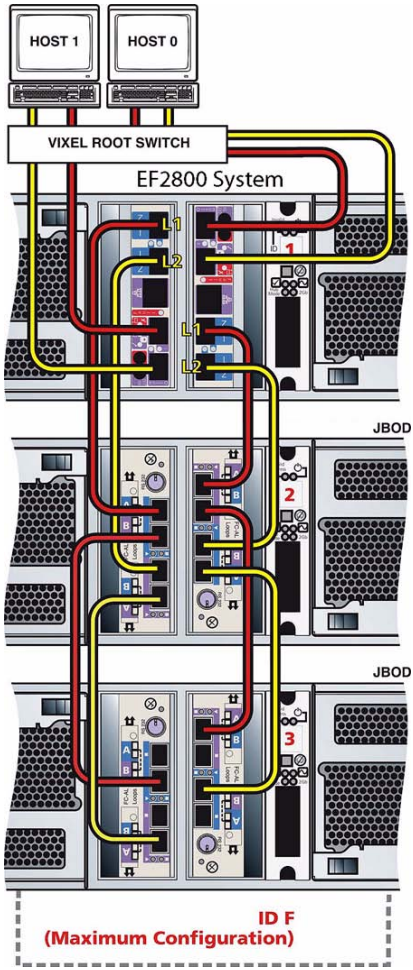

Figure 33. Connecting the Expansion Enclosures to EF2800 (2x8 Mode)

2.7.1 Expansion Enclosures

Multiple enclosures are connected together by using SFP to SFP approved patch cables, or SFPs and optical LC to LC cables. Up to 14 expansion enclosures can be connected to the EF2800 (Figure 33).

NOTE: Loss of power to any enclosure within such a loop will cause the loop to fail.

Power Up
Ensure that all attached JBOD enclosures are fully powered up and all hard drives have spun up prior to powering on the EF2800 enclosure.

Power Down
Ensure that the EF2800 enclosure is powered down prior to powering down the JBOD enclosures.

2.7.2 Enclosure Device Addressing

The EF2800 enclosure supports 15 address ranges (1 to 9, A to F). The thumb wheel switch on the Ops panel is used to select the SEL_ID base address.

Figure 34 below shows the device addresses for the drive slots, with respect to different enclosure ID settings. Each table cell represents a drive slot on the enclosure (when viewing from front). Up to 14 expansion enclosures can be daisy-chained to the EF2800 and each enclosure must have a unique enclosure ID.

NOTE: There must be a drive present in Bay 1/1 or 4/4 to enable SES Communications to operate. Installing drives in both of these bays will provide redundant SES communication paths.

Figure 34. Device Addressing (Mode 2)

	Device Address for Each Drive Slot (x-y) indicates Loop and SEL_ID			
Enclosure ID=1	1-0	1-4	2-7	2-3
	1-1	1-5	2-6	2-2
	1-2	1-6	2-5	2-1
	1-3	1-7	2-4	2-0
Enclosure ID=2	1-8	1-12	2-15	2-11
	1-9	1-13	2-14	2-10
	1-10	1-14	2-13	2-9
	1-11	1-15	2-12	2-8
Enclosure ID=3	1-16	1-20	2-23	2-19
	1-17	1-21	2-22	2-18
	1-18	1-22	2-21	2-17
	1-19	1-23	2-20	2-16
Enclosure ID=4	1-24	1-28	2-31	2-27
	1-25	1-29	2-30	2-26
	1-26	1-30	2-29	2-25
	1-27	1-31	2-28	2-24
Enclosure ID=5	1-32	1-36	2-39	2-35
	1-33	1-37	2-38	2-34
	1-34	1-38	2-37	2-33
	1-35	1-39	2-36	2-32
Enclosure ID=6	1-40	1-44	2-47	2-43
	1-41	1-45	2-46	2-42
	1-42	1-46	2-45	2-41
	1-43	1-47	2-44	2-40
Enclosure ID=7	1-48	1-52	2-55	2-51
	1-49	1-53	2-54	2-50
	1-50	1-54	2-53	2-49
	1-51	1-55	2-52	2-48

Figure 34. Device Addressing (Mode 2)

Enclosure ID=8	1-56	1-60	2-63	2-59
	1-57	1-61	2-62	2-58
	1-58	1-62	2-61	2-57
	1-59	1-63	2-60	2-56
Enclosure ID=9	1-64	1-68	2-71	2-67
	1-65	1-69	2-70	2-66
	1-66	1-70	2-69	2-65
	1-67	1-71	2-68	2-64
Enclosure ID=A	1-72	1-76	2-79	2-75
	1-73	1-77	2-78	2-74
	1-74	1-78	2-77	2-73
	1-75	1-79	2-76	2-72
Enclosure ID=B	1-80	1-84	2-87	2-83
	1-81	1-85	2-86	2-82
	1-82	1-86	2-85	2-81
	1-83	1-87	2-84	2-80
Enclosure ID=C	1-88	1-92	2-95	2-91
	1-89	1-93	2-94	2-90
	1-90	1-94	2-93	2-89
	1-91	1-95	2-92	2-88
Enclosure ID=D	1-96	1-100	2-103	2-99
	1-97	1-101	2-102	2-98
	1-98	1-102	2-101	2-97
	1-99	1-103	2-100	2-96
Enclosure ID=E	1-104	1-108	2-111	2-107
	1-105	1-109	2-110	2-106
	1-106	1-110	2-109	2-105
	1-107	1-111	2-108	2-104
Enclosure ID=F	1-112	1-116	2-119	2-115
	1-113	1-117	2-118	2-114
	1-114	1-118	2-117	2-113
	1-115	1-119	2-116	2-112

2.7.3 Connecting to the RS-232 Port (Optional)

You can optionally use the RS-232 port to configure and monitor the EF2800 system using a computer with a VT-100 or ANSI terminal emulator. You can connect to the RS-232 port on each SM. For more information about the configuration and management capabilities using the RS-232 port and the Disk Array Administrator software, see Appendix C.

You must use the RS-232 cable that came with the EF2800 or one configured like it. The RS-232 cable is a standard 6-conductor, flatline cable with a 3.5mm jack plug to DB9 adaptor.

NOTE: Not all configurations of the EF2800 are supplied with RS232 cables, you can purchase then separately from your supplier if required.

The DB9 pinout is as follows:

Pin	Function
1	No connection
2	Receive (RX)
3	Transmit (TX)
4	No connection
5	Ground

Pin	Function
6	No connection
7	No connection
8	No connection
9	No connection

The RJ-11 cable pinout is straight through (not null modem) as follows:

Pin	Function
1	Ground
2	Transmit (TX)
3	Receive (RX)

Configure the RS-232 port in your terminal emulator software using the following settings:

- Baud rate: 9600, 19200, 38400, 57600, or 115200; 115200 is the EF2800's default

- Data Bits: 8
- Stop Bits: 1
- Parity: None
- Flow Control: None or software Xon/Xoff

To connect to the RS-232 port:

1. Be sure the EF2800 is turned off.
2. Using the RS-232 cable that came with the EF2800, connect the jack plug end of the cable to the RS-232 serial port on one of the SMs.
3. Connect the DB-9 adapter to the serial (COM) port on the computer that will monitor and configure the EF2800.
4. Connect the other end of the RS-232 cable to the DB-9 adapter.
5. Repeat steps 2 through 4 on the other SM.

2.7.4 Connecting to the Ethernet Port

CAUTION: The RJ45 Ethernet connector on the LRC module must not be connected to telecommunications networks.

You use the Ethernet (10/100BaseT) port to configure and manage the EF2800. This lets you manage the EF2800 from a remote computer that is connected to your LAN. The EF2800's default IP address is 10.0.0.1.

NOTE: To comply with radiated emissions requirements, you must use a shielded Ethernet cable that has a properly terminated connection on the end that connects to your network (the EF2800 connector is properly terminated).

To connect to the Ethernet port:

1. Connect one end of the Ethernet cable (RJ-45) to the Ethernet port on one of the SM modules.

   Note that you must use shielded Ethernet cable.

2. Connect the other end of the Ethernet cable to a network hub, controller, or other network connection.
   For information about configuring the EF2800 to use the Ethernet port, see Section 3.2, "Configuring the EF2800 for TCP/IP" on page 45.

3. Repeat steps 1 and 2 on the other SM module.

You are now ready to connect the power cables.

2.8 Powering On the Enclosures

2.8.1 Grounding Checks

Perform these checks to ensure that a safe grounding system is provided.

- If a rack distribution system is being used.
  - Ensure power is removed from the rack.
  - Connect the EF2800 power cord to the rack distribution and the enclosure.
- If a direct connection is made with the EF2800 power cord, ensure that it is connected to the enclosure.

Some electrical circuits could be damaged if external signal cables or power control cables are present during the grounding checks.

- Check for continuity between the earth pin of the IEC 320 connector on one of the Power Supply/Cooling modules and any exposed metal surface of the EF2800 enclosure.

2.8.2 Powering On

Before powering up your EF2800 enclosure please ensure that all the modules are firmly seated in their correct bays and that blank modules are installed in any unused bays.

1. Attach the power cords to the Power Supply/Cooling Modules.

   For maximum redundancy, connect the two power cords on EF2800 (and expansion enclosures) to two different AC power circuits.

2. Turn on the switch on all Power Supply/Cooling modules. Verify that the PSU LEDs are green.

   If expansion enclosures are connected, turn on the expansion enclosures first, then the EF2800.

3. The enclosure(s) will go through the power up sequence. On the Ops Panel, the audible alarm beeps once, all LEDs flash for 7 seconds then the alarm double beeps.

4. Check that the Power LEDs on the Ops panels are green.

NOTE: All LEDs on the Ops Panel should be lit green at power up to indicate that the system is functioning correctly. If any show amber then a problem exists and the procedure in Chapter 10, "Troubleshooting and Problem Solving" on page 141 should be followed.

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5. The drives will automatically be spun up in sequence. Wait until all drives are spun up and ready which is indicated by a green Status (upper) LED on the drive.

6. Refer to Chapters 3, 4, and 5 for information on how to configure the array.

2.9 Status LED Indicators

2.9.1 Power Supply/Cooling Module LEDs

The power supply/cooling module incorporates 4 LEDs (Figure 35), located below the On/Off switch. Under normal conditions the LEDs should all be illuminated constant green. If a problem is detected the color of the relevant LED will change to amber.

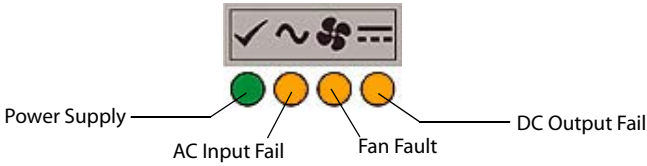

Figure 35. PSU LEDs

2.9.2 Ops Panel LEDs

The Ops Panel LEDs fault and status conditions are shown in Figure 36 and defined in Figure 37.

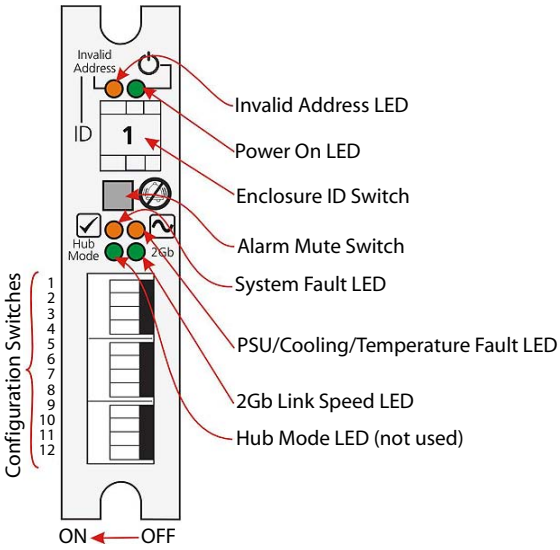

Figure 36. Ops Panel

Figure 37. Ops Panel LED States

Ops Panel LEDs					Other Associated LEDs or Alarm	State Description
Power (Green)	PSU/ Cooling/ Temp (Amber)	System (Amber)	Address Mode Error (Amber)	Loop Speed		
On	Off	Off	Off			Power On, all functions good
On	Off	Off	Off	Off		5V Aux present, overall power failed
On	On	On	On	On	single beep, then double beep	Ops Panel power On (5s) test state
On	On	Off			PSU LEDs or Fan LEDs	Any PSU fault or Fan fault
On	On	Flash				Over or Under temperature
On	Off	On			ESI LED on I/O module A	ESI processor #A Failed
On	Off	On			ESI LED on I/O module B	ESI processor #B Failed
On	Off	On			None	• Unknown (invalid or mixed) LRC module type installed, or • 1^2C Bus Failure (inter ESI processor), or • Backplane autostart watchdog failed.
On	Flashing	Flashing			PSU Removed	PSU removed and System power redundancy check option set. No indication if option not set.
On	Off	Flashing				No SES Drives installed
On	Flashing	On			Intermittent audible alarm	Ops to ESI Communications failed
On			Flashing			Invalid address mode setting (change thumb wheel to valid ranges)

Figure 37. Ops Panel LED States

Ops Panel LEDs					Other Associated LEDs or Alarm	State Description
Power (Green)	PSU/ Cooling/ Temp (Amber)	System (Amber)	Address Mode Error (Amber)	Loop Speed		
On				On		2Gb Drive loop speed selected
On						RAID ONLY Host side Hub mode enabled

Please refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141 for details of any fault indication.

2.9.3 Disk Drives LEDs

Each drive carrier incorporates two status LED indicators, an upper (green) and lower (amber). In normal operation the green LED will be on and will flicker as the drive operates. The amber LED will be on if the drive fails.

Figure 38. Opening the Drive Module Handle

2.10 Understanding how the SMs Work Together

The following terms are associated with how the pair of SM modules work together:.

- SM A and B: One SM module is designated as SM module A (right hand module when viewed from the rear) and the other is designated as SM module B (left hand module). When both SM modules start at the same time, they exchange information related to their current configuration and the ownership of resources. The time and date of SM module B is synchronized with that of SM module A

- Failback: The act of returning ownership of SM module resources from the surviving SM to a previously failed or offline (but now active) SM module. The resources include disk arrays, cache data, and host ID information.

- Failover: The act of temporarily transferring ownership of SM module resources from a failed or offline SM to the surviving SM module. The resources include disk arrays, cache data, and host ID information.

- Force offline: One SM module can force the other SM offline by resetting it and taking it offline. You can also force an SM module offline by pressing the latches on the SM module's handles or using SAM.

- Other: The opposite SM module from the one currently being used (that is, not the SM module you are connected to). In most cases, you can perform all SM module functions from one SM module.

- Ownership: A single SM module has ownership of the following resources: arrays and dedicated spares. When an SM module fails, the other SM module assumes temporary ownership of its resources.

- Put offline: When you use SAM to gracefully take an SM module offline.

- Put online: When you use SAM to put the other SM module online. The other SM module will restart and attempt to come online.

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3

Accessing the EF2800 SAM Software

You can monitor and manage your EF2800 using the EF2800 Storage Array Manager (SAM) software. You should review the following sections to ensure that you are set up to use SAM:

- 3.1, ”SAM System Requirements”, on page 44
- 3.2, ”Configuring the EF2800 for TCP/IP”, on page 45
- 3.3, ”Accessing SAM”, on page 48
- 3.4, ”Configuring the IP Settings Using SAM”, on page 52
- 3.5, ”Setting SAM Passwords and Preferences”, on page 53

Using SAM, you can:

- Configure the EF2800 (see Chapter 3, "Accessing the EF2800 SAM Software" on page 43)
- Create and manage arrays and partitions (see Chapter 5, "Creating and Managing Arrays & Partitions" on page 67)
- Monitor system status (see Chapter 7, "Monitoring System Status" on page 105)
- Manage spares (see Chapter 5, "Creating and Managing Arrays & Partitions" on page 67)
- Manage disk drives and enclosures (see Chapter 9, "Managing Disk Drives & Enclosures" on page 133)

You can access the SAM software using a Web browser and the Ethernet ports on the EF2800.

3.1 SAM System Requirements

You can use SAM from any computer on your network that meets the following minimum system requirements:

- 300 MHz CPU
- 64 MB RAM
- Windows 98, NT 4.0, or 2000 or later; or Sun Solaris 2.7 or later
- Netscape Navigator 4.1 or later or Microsoft Internet Explorer 4.0 or later (configured as described below)

3.1.1 Configuring Your System to Work with SAM

You should configure the following settings for best SAM performance and display:

- Browser's cache preferences
- Pop-up window control software
- Monitor color display

3.1.1.1 Set Browser's Cache Preferences

You must configure your browser's cache preferences to look for a newer version of stored pages every time, that is, it should never display pages from cache. For Internet Explorer follow the steps below...

To set the cache preferences for Internet Explorer:

1. From Internet Explorer, select **Tools** > **Internet Options**.
2. From the General tab, click **Settings** below Temporary Internet Files.
3. Select the **Every visit to the page** option at the top of window.
4. Click **OK** on each window to save your changes.

3.1.1.2 Disable your Pop-Up Window Control Software

SAM uses pop-up windows for several functions. You should disable any software you have installed that disables pop-up windows in your browser.

3.1.1.3 Set Monitor's Color Display

You should set your monitor's color display to the highest setting possible. The following steps describe how to do this for Windows 98, NT, or 2000.

To set your color display:

1. Right-click your Windows desktop.
2. Select **Properties** from the pop-up menu.
3. Go to Settings tab.
4. Select the highest Colors setting from the drop-down list.
5. Click **OK**.

3.2 Configuring the EF2800 for TCP/IP

Before you can access SAM, you must set either a temporary or permanent IP address and subnet mask for at least one SM. The factory default IP address is 10.0.0.1 and the subnet mask is 255.255.255.0. You can do this one of three ways:

- Setting up your computer with an IP address that is compatible with the SM's default IP address and subnet mask—You must connect one Ethernet port of the SM either directly to your computer using a crossover cable or to a hub on a network that is compatible with the default subnet and IP address. You can then access the EF2800 with SAM using the default IP address and set the permanent IP address for each SM. Using this method lets you set the permanent IP addresses of the EF2800 before you connect it to your LAN. See Section 3.3, "Accessing SAM", on page 48 and Section 3.4, "Configuring the IP Settings Using SAM", on page 52.
- Using the serial connection to the EF2800 to set the permanent IP addresses—See 3.2.1, "Accessing EF2800 via Serial Port & Disk Array Administrator", on page 46.

3.2.1 Accessing EF2800 via Serial Port & Disk Array Administrator

You can access the EF2800 using the RS-232 serial port to set the permanent IP addresses. You must use a straight-through serial cable. You cannot use a null modem cable.

Configure the RS-232 port in your terminal emulator software using the following settings:

- Terminal Emulation: VT-100 or ANSI (for color support)
- Font: Terminal
- Translations: None
- Columns: 80

Set the communications parameters for the terminal program as follows:

- Baud Rate: 115,200
- Data Bits: 8
- Stop Bits: 1
- Parity: None
- Flow Control: Software (Xon/Xoff) or None
- Connector: COM1 (typically)

To access the Disk Array Administrator software using the RS-232 serial port:

1. Connect a computer to one of the EF2800's RS-232 ports. For more information, see section 2.7.3, "Connecting to the RS-232 Port (Optional)" on page 34.

2. From the computer connected to the EF2800, start your terminal emulation software.

   Be sure that your terminal emulation software is set to use the correct COM port on your computer. Refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141 for more details on how the EF2800 can auto-detect the baud rate.

3. Press <Ctrl>-<R>. This refreshes the screen. The Disk Array Administrator initial screen displays (Figure 39). You can bypass all events by pressing <Tab>.

Disk Array Administrator
EF2800
Menu Selection Help
No menu is active. When no menu is active, a rotating summary of the current controller status is displayed. Press <Enter> to display the main system menu.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:25:01 2003

Figure 39. Disk Array Administrator Initial Screen

4. Press <Enter>. The System Menu displays (Figure 40).

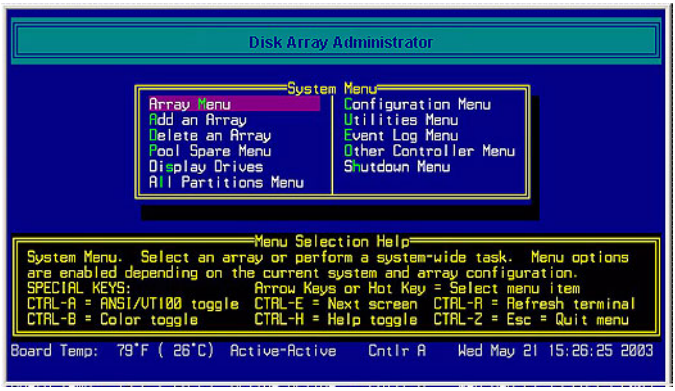
Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Menu Selection Help
System Menu. Select an array or perform a system-wide task. Menu options are enabled depending on the current system and array configuration.
SPECIAL KEYS: Arrow Keys or Hot Key = Select menu item
CTRL-A = ANSI/VT100 toggle CTRL-E = Next screen CTRL-R = Refresh terminal
CTRL-B = Color toggle CTRL-H = Help toggle CTRL-Z = Esc = Quit menu
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:26:25 2003

Figure 40. System Menu

5. Select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

6. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.

7. Select **IP Settings** and press <Enter>. The IP Settings screen displays.

8. Select **IP Address** and press <Enter>. The IP Address screen displays.

9. Enter the permanent IP address and press <Enter>.

10. The system prompts you to confirm changes. Select **Yes** and press <Enter>. The system makes the change.

11. Repeat steps 7 through 10 above for the IP Subnet Mask and IP Gateway options.

12. Repeat steps 1 through 11 for the other SM.

You can now use the IP addresses you set to access the EF2800 using SAM. For information about accessing SAM, see section 3.3 below.

3.3 Accessing SAM

Once you have set up the permanent IP addresses, you can access SAM using your browser and LAN connection. If you are using the default IP address you should set the permanent IP address for each SM. For more information, see Section 3.4 below.

In SAM, you can set up two types of SAM users.

- Monitor: Access to only the **Monitor EF2800** menu that lets you view the status and statistics pages. If you have logged in using a monitor password and selected a page from the **Manage EF2800** menu, SAM displays the Login page, where you can log in with the manage password. SAM then takes you to the page you requested. Three monitor users can be logged in at a time to each EF2800. The default setting is *monitor*.

- Manage: Access to all SAM functions. Only one such user can be logged in at a time to each SM. The default setting is *manage*.

NOTE: SAM permits one manage user to log in to the EF2800 at the same time. If two users log in this way, their configuration changes could conflict.

To access SAM:

1. Open your browser.

2. Enter the IP address for one of the EF2800 SMs in the browser's Address or Location field and press <Enter>.

   The SAM Login page displays (Figure 41). If the page does not display, be sure that you entered the correct IP address. You must be sure that you have set up either a temporary or permanent IP address for at least one SM. For information about setting up the IP addresses for the first time, see Section 3.2 on page 45. If you still cannot access SAM, use the RS-232 connection to check the IP addresses and the HTTP setting. See Section 3.2.1 on page 46 and Section 3.4.1 on page 53.

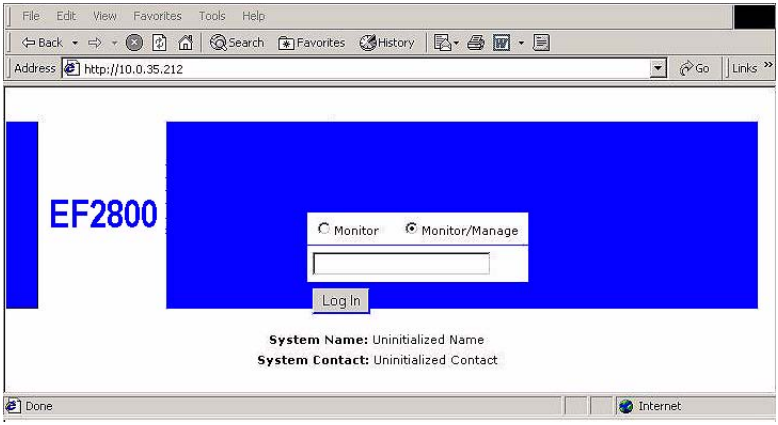

Figure 41. SAM Login Page

3. Select the User Level.
   You log in using either a monitor password, which only lets you check the status of the EF2800 and associated arrays, or a manage password, which lets you check the status and fully configure the EF2800. Only one manage user can log in to each EF2800 at the same time.

4. Enter the Password. The default passwords are as follows:
   - Monitor users—monitor
   - Manage users—manage

   To change the passwords, select **Manage EF2800** > **General Config** > **Passwords/Security**.

5. Click **Log In**. The Status Summary page displays where you can see the status of the EF2800 (Figure 42). Click a link on the left side

of the window to perform each function including creating arrays, viewing EF2800 status, and configuring the host and device ports.

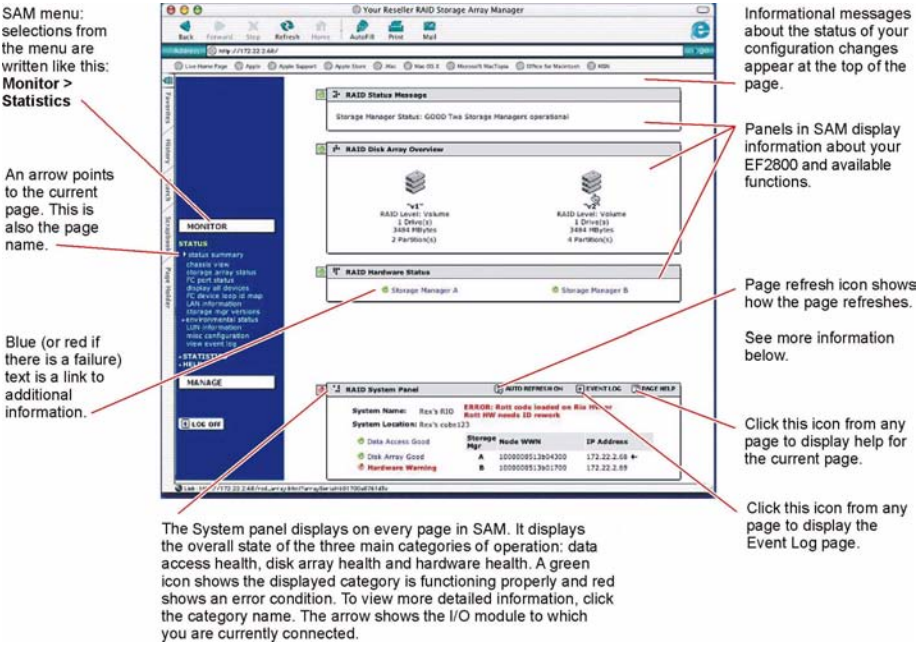
SAM menu: selections from the menu are written like this: Monitor > Statistics
An arrow points to the current page. This is also the page name.
Blue (or red if there is a failure) text is a link to additional information.
Informational messages about the status of your configuration changes appear at the top of the page.
Panels in SAM display information about your EF2800 and available functions.
Page refresh icon shows how the page refreshes.
See more information below.
Click this icon from any page to display help for the current page.
Click this icon from any page to display the Event Log page.
The System panel displays on every page in SAM. It displays the overall state of the three main categories of operation: data access health, disk array health and hardware health. A green icon shows the displayed category is functioning properly and red shows an error condition. To view more detailed information, click the category name. The arrow shows the I/O module to which you are currently connected.

Figure 42. SAM Status Summary Page

You can access all SAM functions from either SM. If one SM becomes unavailable, you can continue to the monitor and manage the EF2800 from the other SM.

3.3.1 Understanding the Page Refresh Icons

The page refresh icon in the System Panel shows one of three refresh states:

- No icon: Pages with no icon have information that is static and does not require refreshing
- Auto Refresh On : Pages with this icon refresh automatically when information on the page changes.
- Click to Refresh : Pages with this icon do not refresh automatically to ensure that information you are entering or

selecting on the page does not get lost during the refresh process. If you want to refresh the page, click the icon. Any information you have entered or selected will change back to the previous settings.

3.3.2 Navigating in EF2800 SAM

You navigate SAM using your mouse and the SAM menu on the left side of each page:

- To select a menu item:
  Click the menu item in the SAM menu on the left side of each SAM page. When you click some menu items, the menu changes to display more items.
- To view more information:
  Click an array or partition icon or click the blue text.
- To view the most current status information on the current page:
  Click your browser's Refresh or Reload button.

NOTE: After 30 minutes of inactivity, SAM times out and returns to the Login page when you click an option. You can change the timeout period by selecting Manage EF2800 > General Config > User Preferences.

3.3.3 Logging Off SAM

When you are finished managing or configuring your EF2800, you should log off SAM. If you do not log off, other manage users cannot log in to the same EF2800 and your IP address stays logged in until the timeout period expires. SAM permits only one manage user to be logged on to each EF2800 at a time. Up to three monitor users can be logged in to each EF2800 at a time.

To log off SAM:

1. From SAM, click **Log Off** at the bottom of the SAM menu. The Log Off page displays.
2. Click **Log Off**.

3.4 Configuring the IP Settings Using SAM

If you accessed SAM for the first time using the default IP you should set up the permanent IP address for each SM. You can also the change the IP address information as needed.

You can set three IP-related settings in SAM:

- IP Address: Internet Protocol address of the EF2800. Factory default is 10.0.0.1. You need two IP addresses, one for each SM.
- IP Mask: Subnet mask. Factory default is 255.255.255.0.
- Gateway: (Optional) Factory default is 0.0.0.0. See your LAN administrator for more information.

If you are not sure what IP address, subnet mask, and gateway to use, contact your LAN administrator.

Record the permanent IP addresses, subnet mask, and gateway below:

- IP address for SM A _____
- IP address for SM B _____
- IP mask _____
- Gateway (Optional) _____

To set the IP address, IP mask, or gateway:

1. In SAM, select **Manage EF2800** > **General Config** > **LAN Configuration**. The LAN Configuration page displays.
2. In the SM IP Configuration panels, enter the permanent IP Address, IP Mask, and Gateway for each SM.

   You can access all SAM functions from either SM, but we recommend setting an IP address for each. If one SM becomes unavailable, you can continue to monitor and manage the EF2800 from the other SM.
3. Click **Change LAN Configuration**.

You will lose access to the EF2800 after the change takes effect. If the EF2800 is not already connected to your LAN, you should connect it now.

You should now use the new IP addresses you just set up to access the EF2800 using SAM. For more information, see Section 3.3, "Accessing SAM" on page 48.

3.4.1 Configuring the HTTP Setting

By default, hypertext transfer protocol (HTTP) is enabled on the EF2800. If you cannot access your EF2800 using SAM, you should use the RS-232 connections to each SM and the Disk Array Administrator software to check that the HTTP setting is enabled. For more information, refer to Appendix I, "LAN Configuration" on page 321.

3.5 Setting SAM Passwords and Preferences

Once you access SAM, you can set up the user passwords and preferences.

3.5.1 Setting SAM Passwords

You can set up SAM passwords for two types of users:.

- Monitor: These users only have access to the functions on the **Monitor EF2800** menu. The default password is monitor. Up to three monitor-only users can be logged in at a time.
- Manage: These users have access to all SAM functions. The default password is manage. Only one manage user can be logged in at a time.

SAM distinguishes users by their IP addresses. If you log in to SAM from multiple browser instances from the same host, SAM considers all instances as a single user. Actions you take in one SAM instance, selecting an array for example, will be reflected in the other SAM instances on the same host. We do not recommend logging in more than once from the same host.

To set SAM passwords:

1. From SAM, select **Manage EF2800 > General Config > Passwords/ Security**. The Passwords/Security page displays.

2. In the Password Configuration panel, enter the **Monitor** and **Manage** passwords. You can enter up to 31 characters for each password. You can only use letters, numbers, and underscores.

3. Click **Change**.

3.5.2 Setting Your User Preferences

You can set your user display preferences to meet your needs...

To set your user preferences:

1. In SAM, select **Manage EF2800** > **General Config** > **User Preferences**. The User Preferences page displays.

2. Set your preferences.

   - Page Refresh Rate: Select how often you want SAM to refresh its pages based on the speed of your computer and Ethernet connection (default is Fast):
     - Fast: Use for fast computers with a fast Ethernet connection (for example, Pentium III 500 MHz or higher with a T1 connection).
     - Medium: Use for slower computers with a slower Ethernet connection (for example, Pentium III 400 MHz and slower with a cable modem or DSL connection).
     - Slow: Use for the slowest computers with a slower Ethernet connection (for example, Pentium II 200 MHz and slower with a dial-up modem of 33.5–56 K connection).
   - Auto-Logoff Timeout: Enter the number of idle minutes before the SAM session times out and requires you to log back in. You can enter between 0 and 255 minutes, with 0 meaning that SAM will not timeout. The default is 30 minutes.
   - Temperature Display Mode: Select Fahrenheit or Centigrade for all temperature status displays. The default is Fahrenheit.

- SAM Configuration Mode: Select whether you want to save the preferences for all SAM sessions and users or for just this SAM session.

3. Click **Change Preferences** to save your changes.

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4

Setting Up the EF2800

SAM lets you set up the FC ports and restart the EF2800. You can:.

- Set up the host ports (see section 4.1)
- Set up the FC device ports (see section 4.2)
- Shut down and restart the SMs (see section 4.3)

4.1 Setting Up the Host Ports

You can set up these host port options:

- Link speed: Sets the speed to 1 Gbit/second or 2 Gbit/second based on your configuration needs (Section 4.1.1).
- Loop ID: If the topology is loop, sets the host port loop ID for each SM (Section 4.1.2).
- Topology: Sets the topology to Loop or Point to Point, based on what the port is connected to (Section 4.1.3).

4.1.1 FC Host Port Link Speed

You can set up the FC link speed for each host port. You should be sure that the speed setting is correct for your configuration.

To set up the host port link speed:

1. In SAM, select **Manage EF2800** > **General Config** > **Host Port Configuration**. The Host Port Configuration page displays.
2. For each Host Port, select the link speed to match the speed of the host (HBA) or switch the port is connected to.
3. Click **Update Host Port Configuration** to save your changes.

4.1.2 FC Host Port Loop IDs

If the topology is set to loop, you can set up the FC loop ID for each SM's host ports. You may need to change the FC loop ID if you want the SM to be at a specific address or if your system checks addresses in reverse order (lowest address first). You must restart both SMs after changing the loop ID.

To set up the host port loop IDs:

1. In SAM, select **Manage EF2800** > **General Config** > **Host Port Configuration**. The Host Port Configuration page displays.

2. In the Advanced Options panel, click the blue Change FC Loop ID text.

   A second Host Port Configuration page displays. If the Requested Loop ID drop-down list is different from the Current ID, your requested change has not yet been processed. Complete the steps below to make the change.

3. For each SM, select the loop ID you want.

   - SOFT: Use this setting if you do not care whether the EF2800's Loop ID changes when you power down and power up. This setting lets the FC loop initialization process determine the Loop ID.

   - Any number between 0 and 125: Select a specific number if you want the Loop ID to stay the same after you power down and power up. SAM cannot tell you which loop IDs are available. To be sure that you have successfully assigned the loop ID you want, check the loop ID here or from **Monitor EF2800** > **FC Port Status** after you restart the SM. If the SM cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.

4. Click **Save and Continue** to save your changes and return to the first Host Port Configuration page.

5. Restart both SM by selecting **Manage EF2800** > **Manage Modules** > **Shutdown/Restart**. (for more information, see 4.3.1 on page 62).

4.1.3 FC Host Port Topology

You can set up the FC topology for each host port. You should be sure that the topology setting is correct for your configuration...

To set up the host port topology:

1. In SAM, select **Manage EF2800** > **General Config** > **Host Port Configuration**. The Host Port Configuration page displays.
2. In the Advanced Options panel, click the blue Change Host Port Topology text.

   A second Host Port Configuration page displays. The current topology setting displays for each host port.
3. For each SM module, select the topology option you want.
   - Loop: Use this option for all configurations except when the EF2800 is connected to a switch F-port.
   - Point to Point: Use this option *only* when you connect the EF2800 to a switch F-port. If you change from Loop to Point to Point after already establishing a public loop connection, the switch may ignore subsequent attempts to perform point to point initialization. To resolve this, refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141.
4. Click **Save and Continue** to save your changes and return to the first Host Port Configuration page.

4.2 Setting Up the FC Device Ports

You can set up two FC device port options:

- Loop ID: Sets the device port loop ID for each SM (Section 4.2.1).
- Link speed: Sets the speed to 1 Gbit/second or 2 Gbit/second based on what the port is connected to (Section 4.2.2).

4.2.1 FC Device Port Loop IDs

The EF2800 assigns each of its FC device ports one of the FC loop IDs. You can change the loop ID assigned to each port. You may need to do this if the default IDs (125) conflict with an enclosure management processor (EMP) ID....

To configure the FC device port loop IDs:

1. In SAM, select **Manage EF2800** > **General Config** > **Device Port Configuration**. The Device Port Configuration page displays.
2. For each SM module, select the FC Loop ID you want.
   - SOFT: Use this setting if you do not care whether the port's loop ID changes when you power down and power up. This setting lets the FC loop initialization process determine the initiator ID.
   - Any number between 0 and 125: Select a specific number if you want the loop ID to stay the same after you power down and power up. SAM cannot tell you which IDs are available. To be sure that you have successfully assigned the ID you want, check the ID here or from **Monitor EF2800** > **FC Port Status** after you restart the EF2800. If the SM cannot get the specified loop ID during the loop initialization process, it will try to get a soft address.
3. Click **Update Device Port Configuration** to save your changes.
4. Restart both SMs by selecting **Manage EF2800** > **Manage Modules** > **Shutdown/Restart** (For more information, see Section 4.3.1).

4.2.2 FC Device Port Link Speed

You can set up the FC link speed for the device ports on each SM. Please refer to section 1.2.2.1, "Ops Panel Status LED Indicators and Switches" on page 6 for further information.

4.3 Restarting the SMs

You have several options when you need to shut down or restart an SM:

- Restart one or both SMs: Gracefully shuts down and restarts the selected SM module. This restarts both the storage manager and the LAN Subsystem on the SM module and ensures that any data in the SM's write-back cache is written to disk. Use this option when you have changed a configuration that requires restarting (SAM messages say when you need to do this) or when you want to restart an EF2800 that does not seem to be working properly (see page 62).
- Shut down one or both SMs: The shutdown function gracefully shuts down one or both SM modules. This shuts down both the storage controller and LAN Subsystem on the selected SM module and ensures that any data in the SM module's write-back cache is written to disk. Use this option when you plan to power down the whole EF2800 (see page 63).
- Put the SM offline: Gracefully takes the SM module offline, which halts I/0 and makes sure that any data in the write-back cache is written to disk. Use this option when you need to replace an SM module (see page 64).
- Put the SM online: Puts the selected SM module online. Use this option when an SM module is offline. This does not restart the LAN Subsystem (see page 64).
- Kill the SM: Forces the SM offline when using the "Put SM Offline" option does not work and you need to remove the module. This does not write the write-back cache to disk, but relies on the mirrored cache in the other SM module to write the data to disk. Using this option will cause users to lose access to data if the other SM module is not online (see page 65).
- Restart the LAN Subsystem: Restarts the LAN Subsystem if you are having difficulty communicating with the SM module using SAM (see page 66).

4.3.1 Restarting the SMs

You may need to restart one or both SM modules when you have changed a configuration that requires restarting (SAM messages say when you need to do this) or when an SM module does not seem to be working properly. This shuts down and restarts both the storage controller and the LAN Subsystem on the SM module and ensures that any data in the write-back cache is written to disk.

CAUTION: If you restart both SM modules, you will lose access to SAM and users will lose access to data until the SM modules have restarted. You will have to log back in to SAM.

To restart the SMs:

1. In SAM, select **Manage EF2800** > **Manage Modules** > **Shutdown/ Restart**. The Shutdown/Restart page displays.

2. In the Restart EF2800 panel, select whether you want to restart one or both SMs (Figure 43). Click **Restart**.

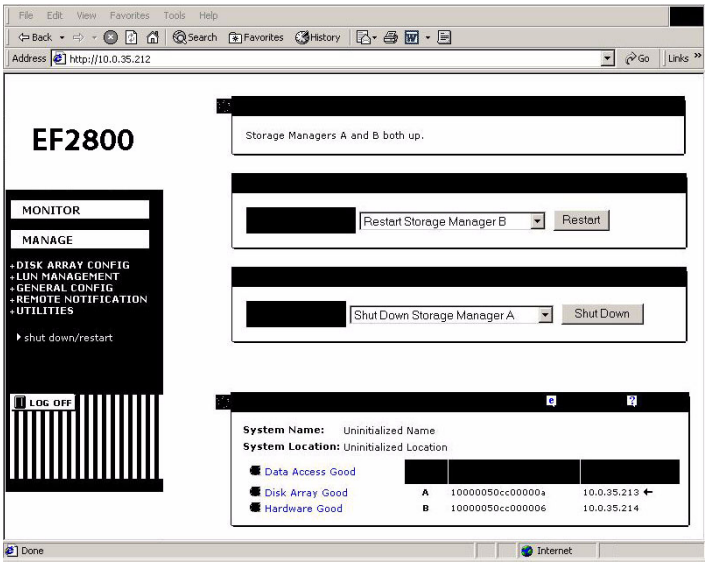

Figure 43. SAM Restart SM Panel

4.3.2 Shutting Down the SMs

You may need to shut down one or both SM modules when you plan to power down the whole EF2800 system. This shuts down both the storage manager and the LAN Subsystem on the SM module and ensures that any data in the write-back cache is written to disk.

If you shut down both SM modules, you will lose access to SAM and users will lose access to data. To restart the SM modules, you must first turn off the power, then turn the power back on.

You should shut down both SM modules when you need to power down the whole system for maintenance, repair, or a move. We strongly recommend that you shut down the SM modules gracefully using Shutdown to ensure that the write-back cache is written to disk. Do not just turn off the power.

To shut down the SMs:

1. In SAM, select **Manage EF2800** > **Manage Modules** > **Shutdown/ Restart**. The Shutdown/Restart page displays.
2. In the Shutdown SMs panel, select whether you want to shut down one or both SM modules (Figure 44).
3. Click **Shut Down**.

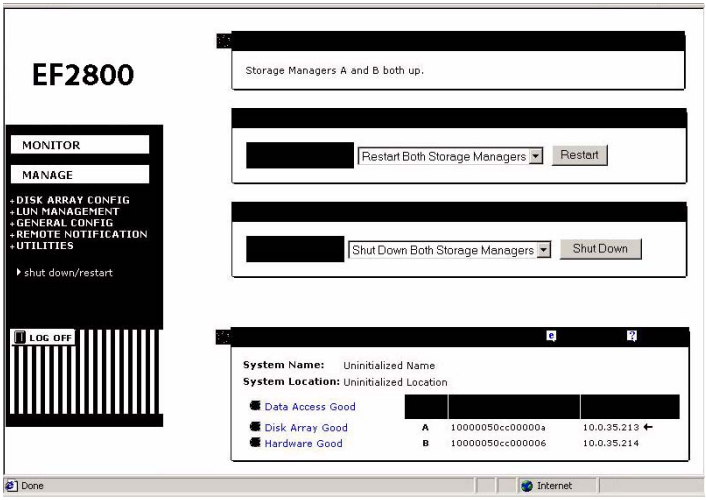

Figure 44. SAM Shutdown SM Screen

4.3.3 Putting an SM Offline

You can put an SM module offline. This gracefully takes the SM module offline, which halts I/0 and makes sure that any data in the write-back cache is written to disk. Use this option when you need to replace an SM module.

CAUTION: To ensure continuous availability of the system, be sure that the other SM module is online. For more information, see Section 7.1, "Displaying SAM Status Information" on page 105.

If the other SM module is not online, resolve the problem or replace it before putting the SM module offline. For more information, refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141.

To put an SM offline:

1. From SAM, select **Manage EF2800** > **Manage Modules**. The Modules Online/Offline page displays.
2. Click the **Module Link** of the SM module you want to put offline. The options available for the selected module display below. The options available depend on the module selected and its status.
3. Select **Put SM Offline**.
4. Click **Perform this Operation** to put the selected module offline. The Status LED for the offline module turns red and SAM shows the module as offline.

4.3.4 Putting an SM Online

If you used the “Put SM Offline” function and did not remove the SM module, you can put the SM module back online. You can also use the Put SM Online function when an SM is offline for any reason.

NOTE: You can only put the other SM module online. You cannot put the SM module that SAM is connected to online.

To put an SM online:

1. From SAM, select **Manage EF2800** > **Manage Modules**. The Modules Online/Offline page displays.
2. Click the **Module Link** of the module you want to put online. The options available for the selected module display below. The options available depend on the module selected and its status.
3. Select **Put SM Online**.
4. Click **Perform this Operation** to put the selected module online. The Status LED for the module turns green and SAM shows the module as online.

4.3.5 Killing an SM

You may need to force an SM module offline. Use the Kill SM option only when the Put SM Offline command does not work and you must take a module offline.

CAUTION: If the other SM module is offline, Killing the second SM module will cause users to lose access to data and will interrupt the flow of data.

To Kill an SM:

1. From SAM, select **Manage EF2800** > **Manage Modules**. The Modules Online/Offline page displays.
2. Click the **Module Link** of the module you want to force offline. The options available for the selected module display below. The options available depend on the module selected and its status.
3. Select **Kill SM**.
4. Click **Perform this Operation** to kill the selected module. The Status LED for the module turns red and SAM shows the module as offline.

4.3.6 Restarting the LAN Subsystem

If you are having difficulty communicating with the EF2800, you can restart the LAN Subsystem in each SM.

To restart the LAN Subsystem:

1. From SAM, select **Manage EF2800** > **Manage Modules**. The Modules Online/Offline page displays.
2. Click the **Module Link** of the SM module whose LAN Subsystem you want to restart.
3. Select **Restart LAN Subsystem**.
4. Click **Perform this Operation** to restart the LAN Subsystem.

If you selected the SM module that SAM is currently connected to, you will lose access to SAM for about a minute, and you must log back in to SAM.

5

Creating and Managing Arrays & Partitions

Using SAM, you can create and manage arrays and partitions. You can perform the following array-related functions:

- Create arrays (see page 67)
- Manage arrays (see page 74)
- Manage partitions (see page 78)
- Manage spares (see page 82)

5.1 Creating Arrays

You can create an array anytime you have enough available disk drives for the array type you want to create. One SM module owns each array you create. For most purposes, which SM module owns an array does not matter. SAM automatically selects the owner (or you can select the owner yourself) and balances the number of arrays each SM owns.

When an SM module fails, the other SM module assumes temporary ownership of the failed SM's arrays and dedicated spares. For more information about how the SM modules work together see section 2.10, "Understanding how the SMs Work Together" on page 41.

The maximum size for any array is 2 TB. Figure 45 describes the drive requirements for each RAID level.

Figure 45. Array drive requirements by RAID level

RAID level	Minimum number of drives per array	Maximum number of drives per array
Volume	1	1
RAID 0	2	16
RAID 1 (Mirrored)	2	16
RAID 3	3	16
RAID 4	3	16
RAID 5	3	16
RAID 10	4	16
RAID 50	6	32

NOTE: Before you create more than one array, you must be sure that your host operating system supports multiple logical unit numbers (LUNs). Most operating systems do support multiple LUNs or have an option you can enable to support multiple LUNs. If your operating system does not support multiple LUNs, the host will only be able to see one array at LUN 0.

You can create an array that has just one partition or multiple partitions. Single-partition arrays work well in environments that need one large, fault-tolerant storage space for data on one server. A large database accessed by users on a single server that is used only for that application is an example. Multiple-partition arrays work well when you have very large disk drives and you want to make the most efficient use of disk space for fault tolerance (parity and spares).

You can add partitions to any free space in an array. For more information, see Section 5.3.2 on page 80.

To create an array:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Create an Array**. The Create an Array page displays (top panel shown) (Figure 46).

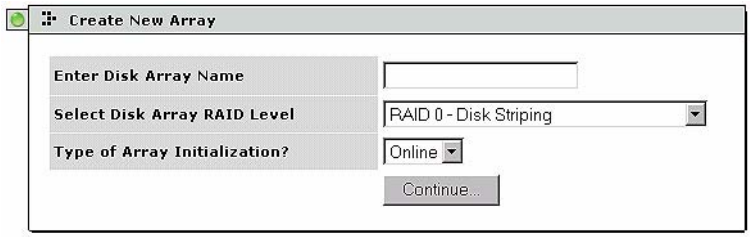

Figure 46. SAM - Create New Array Screen

2. Enter the array name.
You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (“). You can change the name later.

3. Select the RAID level.
Select the type of array you want to create. A volume is a single drive similar to just a bunch of disks (JBOD) except that it includes metadata. For more information about RAID levels, refer to Appendix B.

4. Select the type of array initialization.

- Online: This option lets you begin using the array immediately after creating it, while the array initialization process runs. It uses the verify method to create the array, which takes longer than the zero method.
- Offline: This option means you must wait for the array initialization process to finish before using the array. It uses the zero method to create the array, which is faster than the verify method. You can only create one partition now on the array using this method. You can add partitions later.

5. Click **Continue** to continue the array creation process.
The Select Drives screen appears with a list of available disk drives (top panel shown) (Figure 47).

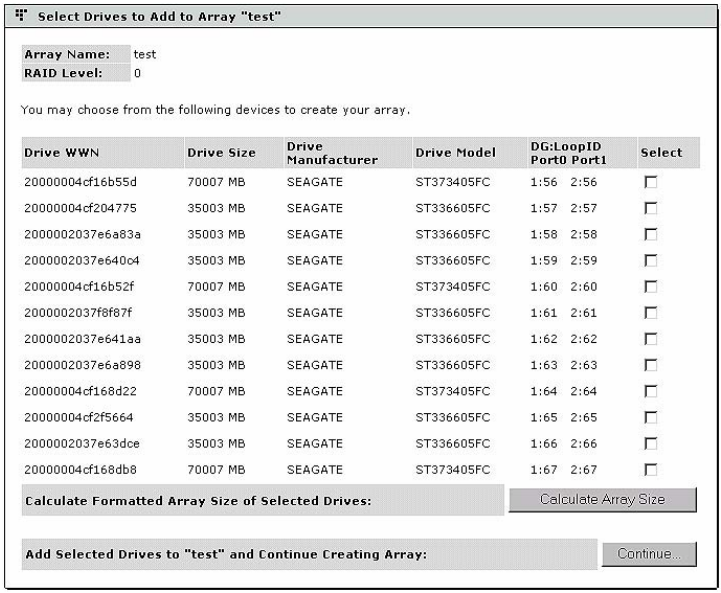
Select Drives to Add to Array "test"
Array Name: test
RAID Level: 0
You may choose from the following devices to create your array.
Drive WWN | Drive Size | Drive Manufacturer | Drive Model | DG:LoopID Port0 Port1 | Select
20000004cf16b55d 70007 MB SEAGATE ST373405FC 1:56 2:56
20000004cf204775 35003 MB SEAGATE ST336605FC 1:57 2:57
2000002037e6a83a 35003 MB SEAGATE ST336605FC 1:58 2:58
2000002037e640c4 35003 MB SEAGATE ST336605FC 1:59 2:59
20000004cf16b52f 70007 MB SEAGATE ST373405FC 1:60 2:60
2000002037f8f87f 35003 MB SEAGATE ST336605FC 1:61 2:61
2000002037e641aa 35003 MB SEAGATE ST336605FC 1:62 2:62
2000002037e6a898 35003 MB SEAGATE ST336605FC 1:63 2:63
20000004cf168d22 70007 MB SEAGATE ST373405FC 1:64 2:64
20000004cf2f5664 35003 MB SEAGATE ST336605FC 1:65 2:65
2000002037e63dce 35003 MB SEAGATE ST336605FC 1:66 2:66
20000004cf168db8 70007 MB SEAGATE ST373405FC 1:67 2:67
Calculate Formatted Array Size of Selected Drives:
Calculate Array Size
Add Selected Drives to "test" and Continue Creating Array:
Continue...

Figure 47. SAM - Select Drives for Array

6. Select the drives you want to use in the array.
All available drives are listed. Available drives are those that are not members of an array and are not assigned as a dedicated or global spare. You may want to select drives from different LRC I/O modules, which keeps the array online even if one LRC I/O module becomes unavailable.

7. Click **Calculate Array Size** to display the size of the array based on the selected drives.

8. If you are creating a redundant (fault-tolerant) array (RAID 1, RAID 3, RAID 4, RAID 5, RAID 10, and RAID 50), select whether you want to add dedicated spares to the array.

A dedicated spare is an available drive that is assigned to a specific array. The drive cannot be used in any other array or as a global spare once it is assigned as a dedicated spare to an array.

9. Click **Continue** to continue the array creation process.

10. If you selected Yes to adding dedicated spares, select the drives you want add as dedicated spares and click **Continue**.

The Configure Partition screen appears (top panel shown) (Figure 48).

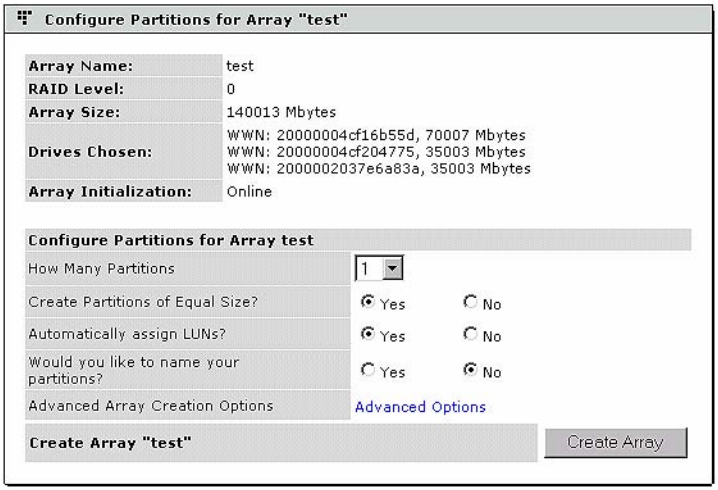

Figure 48. SAM - Configure Partition for Array

11. Select the following options for your array:

- How Many Partitions?: Select the number of partitions you want in your array. The partitions discussed here are logical subdivisions of an array to which you can assign a LUN. This type of partition is not the same as a partition you create with your operating system or third party tools. To add a partition to an array that has only one partition, you must first delete the existing partition, which also deletes the data, then add new partitions. For more information about partitions, see Section 5.3.1 on page 78.
- Create Partitions of Equal Size?: If you select **No**, you can enter the size for each partition on the next page.
- Automatically assign LUNs?: If you select **No**, you can enter the LUN for each partition on the next page.
- Would you like to name your Partitions?: If you select **Yes**, you can enter a name for each partition on the next page. If you

select **No**, you can name your partitions later (see Section 6.3.2, "Changing a Partition Name" on page 96).

- Advanced Array Creation Options*:* Click **Advanced Options** if you want to set the following, then click **Continue**:
- Array Chunk Size: The default is 64 KB. The chunk size is the amount of contiguous data that is written to an array member before moving to the next member of the array. To determine the appropriate chunk size, refer to your operating system documentation. For example, the default chunk size for Windows NT and many other operating systems is 64 KB. If you are using the array for a database with very small records, you may want to use a smaller chunk size.
- Preferred Array Owner: Select the SM you want to own this array. If you do not make a selection here, SAM automatically selects the owner and balances the number of arrays each SM owns. In most situations, which SM owns the array does not matter. A single SM has ownership of arrays and dedicated spares. When an SM fails, the other SM assumes temporary ownership of its resources.

12. Click **Create Array** to continue the array creation process. The EF2800 creates the array and displays Add Partition screen (Figure 49).

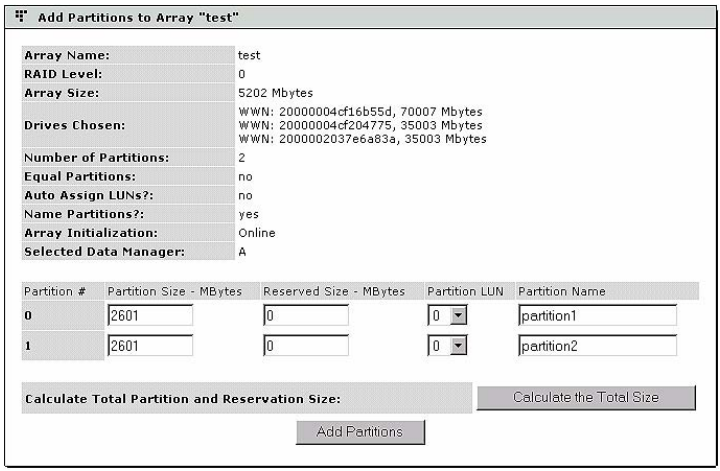
Add Partitions to Array "test"
Array Name: test
RAID Level: 0
Array Size: 5202 Mbytes
Drives Chosen: WWN: 20000004cf16b55d, 70007 Mbytes
WWN: 20000004cf204775, 35003 Mbytes
WWN: 2000002037e6a83a, 35003 Mbytes
Number of Partitions: 2
Equal Partitions: no
Auto Assign LUNs?: no
Name Partitions?: yes
Array Initialization: Online
Selected Data Manager: A
Partition # | Partition Size - MBytes | Reserved Size - MBytes | Partition LUN | Partition Name
0 | 2601 | 0 | 0 | partition1
1 | 2601 | 0 | 0 | partition2
Calculate Total Partition and Reservation Size:
Calculate the Total Size
Add Partitions

Figure 49. SAM - Add Partition for Array

After you click **Create Array**, the array exists and any drives you assigned to the array are no longer available for other uses. What displays here depends upon the options you selected in the previous page. It displays either a progress bar or fields to set up your partitions, depending on your selections.

13. If any of the following fields display, enter the appropriate information and click **Add Partitions**:

- Partition Size: Contains the partition size based on evenly-sized partitions. Enter the size you want for each partition in MB. If you want to see the total size of the partitions based on the sizes you entered, click **Calculate the Total Size**.

- Partition LUN: Contains the default LUN. Most UNIX, Linux, and Macintosh operating systems require that the management LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If you are using a software tool that your company developed to configure and manage the EF2800 (this application uses CAPI to communicate with the EF2800), you must have a management LUN. If you are not using a software tool that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0. To set the management LUN, select **Manage EF2800** > **LUN Management** > **Change Management LUN**.

- Partition Name: Contains a default name. Edit the name as needed. You can enter up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (“). You can change the name later.

14. A message notifies you that the array is being initialized and a progress bar displays. This progress bar does not update. To see the status of the initialization process, select **Array Utility Progress** from the SAM menu.

The array initialization process takes from several minutes to more than an hour depending on the array type (volume, RAID 0, and RAID 1 are the fastest), array size, drive speed, and other processes running on the EF2800.

You can perform other functions during the initialization. If you find that you need to change the disk drives or some other array configuration, you can stop the array initialization process (see Section 5.2.2 on page 75).

NOTE: Most operating systems, such as Windows NT 4.0, require you to restart the host system to see a new LUN. Windows 2000 can recognize new LUNs by selecting Refresh from the Computer Management Window. NetWare v3.12 and later can recognize new devices by typing the command SCAN FOR NEW DEVICES at the console prompt. Other operating systems might have similar features.

5.2 Managing Arrays

.SAM lets you manage your arrays in a variety of ways. You can:

- Stop the initialization process (see page 75)
- Reconstruct an array (see page 75)
- Expand array capacity (see page 76)

5.2.1 Understanding the Array Icons

Figure 50 describes the array icons in SAM that show the status of the array.

Figure 50. Array Icons

Icon	Description
	Array is online with all disk drives working.
	Array is critical. It is normal for an array to be critical while the array initializes. If the array is initializing, the percent complete displays. If an array is critical for any reason other than initializing, you should review the status information and take the appropriate action, such as replacing a disk drive. You can still use an array in this state, but you should resolve the problem as soon as possible.

Figure 50. Array Icons

Icon	Description
	Array utility (Verify, Reconstruct, or Expand) is running. The utility and percent complete display. You can continue using an array in this state.
	Array is offline, which means that you cannot use the array.

5.2.2 Stopping the Array Initialization Process

If you need to change the disk drives or some other array configuration, you can stop the array initialization process.

CAUTION: If you stop the initialization process, the array goes offline and its data is not available to users.

You must delete the array before you can use the drives in another array.

To stop the array initialization process:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Abort an Array Utility**. The Abort an Array Utility page displays with a list of existing arrays.
2. Select the array you want.
3. Click **Abort Array Initialization**.

5.2.3 Reconstructing an Array

The EF2800 automatically reconstructs redundant arrays (RAID 1, RAID 3, RAID 4, RAID 5, RAID 10, and RAID 50) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fail.

If a Reconstruct does not start automatically, it means that no valid spares are available. To start a Reconstruct, replace the failed drive, and add the new drive as a dedicated spare (see Section 5.4.2.1 on page 84) or as a global spare (see Section 5.4.3.1 onpage 85). Remember that any global spares added might be used by any critical array, not necessarily the array you want.

You can also use the Dynamic Spares function to start a reconstruct when you replace a failed drive without having to add the drive as a spare. For more information, see Section 5.4.1 on page 83.

5.2.4 Expanding Array Capacity

You can expand array capacity without stopping I/O activity, so you can continue using the array while the expansion process runs. You can only expand one array at a time.

Expanding an array adds free space at the end of the array. You can then can add a new partition or expand an existing partition into the free space. For more information about partitions, see Section 5.3.1 on page 78.

Notes:

- Expanding an array here does not change the size of the host operating system partitions that reside on the array, because the RAID controller is working at the block level not the file system level of the operating system. To use the new space, you must create a new operating system partition using the newly added space or use a third-party application specific to the operating system to change the operating system partition size.
- How you create a new operating system partition or resize an existing one depends upon the operating system. Most operating systems cannot resize an existing partition. Refer to your operating system documentation.

The number of drives you can add to an array depends upon the RAID level as shown in Figure 51. You also cannot exceed the maximum number of drives for each RAID level.

Figure 51. Drive additions by RAID level

RAID Level	Number of Drives you can add	Max. # of Drives
RAID 0	1 to 4 at a time up to the maximum	16
RAID 1 (Mirrored)	Cannot expand	16
Volume Set	Cannot expand	1
RAID 10	2 or 4 at a time up to the maximum	16
RAID 3, 4, or 5	1 to 4 at a time up to the maximum	16
RAID 50	You can expand the array, one RAID 5 array at a time up to the maximum number of drives. All RAID 5 arrays must contain the same number of drives.	32

NOTE: Once you start expanding array capacity, you cannot stop it. The Expand function may take an hour or more to complete, depending on the array type, array size, drive speed, utility priority, and other processes running on the EF2800.

To expand an array:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Expand Array**. The Expand Array page displays with a list of existing arrays and available drives.

2. Select the array you want to expand.

3. Select one or more drives you want to use to expand the array.

4. Click **Expand This Array**.

Expansion begins and the percentage completed displays. You can perform other functions during the expansion. To check the progress of the expansion, select **Manage EF2800** > **Disk Array Config** > **Array Utility Progress** or any item from the **Disk Array Config** menu. The status of the expansion displays in the list of arrays.

5.3 Managing Partitions

The SAM software lets you manage partitions in a variety of ways... You can:

- Add a partition (see page 80)
- Expand a partition (see page 81)

5.3.1 Understanding Partitions

The partitions discussed here are logical subdivisions of an array to which you can assign a LUN. You can add, expand, rename, change the LUN, and delete partitions using SAM. This type of partition is *not* the same as a partition you create with your operating system or third party tools.

You can create an array with one or more partitions, each of which is assigned a LUN. Using multiple partitions lets you create one very large array making efficient use of your disk drives. For example, you could create one very large RAID 5 array and assign one dedicated spare to the array. This minimizes the amount of disk space allocated to parity and spares compared to the space required if you created five or six smaller RAID 5 arrays.

You can give each partition a name. We recommend assigning names that indicate how the partition will be used. For example, if the first partition will be used to store your customer database, give it a name like: cust_database.

When you create an array, you can set how many partitions you want and their sizes. If the total size of the partitions equals the size of the array, you will not have any free space as shown in Figure 52. In this example, partitions are equal in size and use all of the array's space.

Figure 52. Array after creating five partitions

You can also create fewer partitions that do not equal the array's size. That would leave free space in which you can add or expand partitions later as shown in Figure 53.

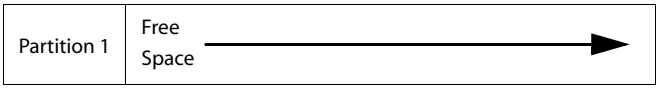

Figure 53. Array after creating one partition

SAM assigns each partition a unique serial number and sequence number. It assigns sequence numbers in the order the partitions are created, so the first partition on an array is number 1, the second is 2, and so on. You can create additional partitions in the remaining free space or you can expand a partition with some limitations.

You can only expand a partition into contiguous, following, free space. In Figure 53, you can expand partition 1 or you can create additional partitions in the free space...

After you partition all of the free space, you can expand the size of a partition only by deleting a partition that follows (has a higher number than) the one you want to expand. In Figure 54, you can delete partition 3, then expand partition 2 to use some or all of partition 3's space.

Figure 54. Array with five partitions

CAUTION: If you delete a partition, you also delete all data stored in the partition. Be sure that you back up all data before deleting a partition.

When you expand an array, you add free space at the end of the array as shown in Figure 55. For more information about expanding an array, see Section 5.2.4 on page 76

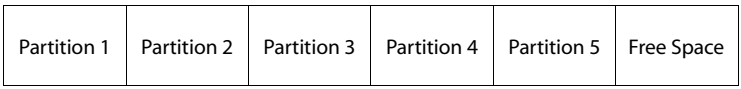

Figure 55. Array with five partitions after expanding the array

After expanding an array, you can either add a partition or expand the last partition to use the new free space. You can also delete one or more partitions and expand a partition into the space.

5.3.2 Adding a Partition

You must have free space in the array before you can add a partition. You can create free space by deleting an existing partition or by expanding the array. For more information, see Section 5.2.4 on page 76.

You can add partitions on an array until you use all of the free space. For more information about partitions, see Section 5.3.1 on page 78.

To add a partition:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Add Partition**. The Add Partition page displays with a list of existing arrays and available drives.

2. In the Select an Array to View LUN Information panel, select the array you want to add a partition to.

3. In the Partition Menu panel, select the Free Space.

4. In the Add Array Partitions panel, enter following information:
   - Enter Partition Size: Enter the size you want the partition to be. Enter the size in increments of 1 MB.
   - Enter Partition Name: Enter the partition name. You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (“).
   - Enter Partition LUN: Select a partition LUN.

5. Click **Add Partition**.

NOTE: Most UNIX, Linux, and Macintosh operating systems require that the management LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If you are using a software tool that your company developed to configure and manage the EF2800 (this application uses CAPI to communicate with the EF2800), you must have a management LUN. If you are not using a software tool that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0.

5.3.3 Expanding a Partition

You can expand an existing partition, with some limitations. You can only expand a partition into contiguous, following, free space. For more information about partitions, see Section 5.3.1 on page 78.

To expand a partition:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Expand Partition**. The Expand Partition page displays with a list of existing arrays.

2. In the Select an Array to View LUN Information panel, select the array whose partition you want to expand. A graphical depiction of the selected array's partitions and a list of the partition names and sizes displays below.

3. In the Partition Menu panel, select the name of the partition you want to expand.

   You can only expand a partition that has free space after (to the right of) it. You can create free space by deleting a partition, but deleting a partition also deletes all data on the partition.

   If the selected partition can be expanded, a graphical depiction of the selected partition and the available free space displays below.

4. In the Expand panel, enter the amount of free space that you want to add to the selected partition in MB. You must enter the amount in increments of 1MB.

5. Click **Expand Partition**.

Expansion begins and the percentage completed displays. You can perform other functions during the expansion. To check the progress of the expansion, select **Manage EF2800** > **Disk Array Config** > **Array Utility Progress** or any item from the Disk Array Config menu. The status of the expansion displays in the list of arrays.

5.4 Managing Spares

RAID controllers automatically reconstruct redundant (fault-tolerant) arrays (RAID 1, RAID 3, RAID 4, RAID 5, RAID 10, and RAID 50) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fails.

If you enable the Dynamic Spares option and a drive fails, you can replace the drive and the SM will rescan the bus, find the new disk drive, and automatically start reconstruction of the array (see page 83).

You can set up two types of spare drives:

- Dedicated: Available drive that is assigned to a specific array (see page 84).
- Global: Available drive that is assigned as a global spare, which can provide a spare for any failed drive in any redundant array. Global spares are available to any redundant array on the EF2800. If a drive in an array fails, the SM can use a global spare to reconstruct the critical array (see page 85).

When a drive fails, the EF2800 looks for a dedicated spare first. If it does not find a properly sized dedicated spare, it looks for a global spare.

If a reconstruct does not start automatically, it means that no valid spares are available. To start a reconstruct, you must:

1. Replace the failed drive, if no other drive is available.
2. Enable Dynamic Spares or add the new drive or another available drive as a dedicated spare to the array or as a global spare.

For more information, see Section 5.4.1, "Enabling Dynamic Spares" on page 83 or Section 5.4.2.1, "Adding a Dedicated Spare" on page 84. Remember that any global spares added might be used by any critical array, not necessarily the array you want.

5.4.1 Enabling Dynamic Spares

The Dynamic Spares option lets you use all of your disk drives in redundant arrays, without assigning one as a spare. For example, if you enable Dynamic Spares and a drive fails, you can replace the drive and the EF2800 will rescan the bus, find the new disk drive, and automatically start reconstruction of the array. You do not have to assign the new drive as a spare for the reconstruct to start.

With Dynamic Spares enabled, if you have spares or available drives, the EF2800 first looks for a dedicated or global spare for the reconstruction. If none is found, it uses an available drive, which the EF2800 automatically assigns as a spare and starts reconstruction.

You must make sure that the new or available drive has enough capacity to replace the smallest member in the array and does not contain metadata (for information about clearing metadata, refer to Section G.1.2, "Clearing Metadata from a Drive" on page 288).

NOTE: Performance in systems *without* an enclosure management processor (EMP) will decrease if an array becomes critical with this option enabled and there are no available drives to start reconstruction. To minimize the performance impact, consider adding a dedicated spare or global spare instead of enabling Dynamic Spares.

To enable dynamic spares:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**. The Option Configuration page displays.
2. For Dynamic Spare Config, select **Enabled**.
3. Click **Change Options** to save your changes.

5.4.2 Managing Dedicated Spares

Dedicated spares are available disk drives that you assign as a spare to a specific array. The disk drive must be as large as the smallest member of the array. You cannot use a dedicated spare drive as a member of an array or as a global spare.

Although using a dedicated spare is the most secure way to provide spares for your arrays, it is also expensive to keep a spare drive assigned to each array. An alternative method is to assign one or more unused drives as global spares or to enable Dynamic Spares (see Section 5.4.3 on page 85 and Section 5.4.1 on page 83).

5.4.2.1 Adding a Dedicated Spare

You assign dedicated spare drives to a specific array. If a member drive in the array fails, the EF2800 uses a dedicated spare drive to automatically reconstruct the array. You can add dedicated spare drives to redundant arrays (mirrored [RAID 1 and RAID 10] and parity [RAID 3, RAID 4, RAID 5, and RAID 50]). You can assign up to four dedicated spare drives to an array.

NOTE: A dedicated spare must have enough capacity to replace the smallest member in the array.

To add a dedicated spare:

1. From SAM, select **Manage EF2800 > Disk Array Config > Add Dedicated Spare**. The Add Dedicated Spare page displays listing all available drives. If a drive was a member of an array and was removed from the array, you cannot use it as a spare until you clear the drive's metadata. For information about clearing metadata, refer to Section G.1.2, "Clearing Metadata from a Drive" on page 288.

2. In the EF2800 Array Overview panel, select the array you want to add a spare to.

3. In the Add Spares to Array panel, select the drive you want to add as a spare.

4. Click **Add Spares to This Array**.

5.4.2.2 Deleting a Dedicated Spare

You can delete a dedicated spare drive from an array at any time...

To delete a dedicated spare:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Delete Dedicated Spare**. The Delete Dedicated Spare page displays with a list of existing arrays and dedicated spares.

2. In the EF2800 Storage Array Overview panel, select the array you want to delete a spare from.

3. In the Delete Spares panel, select the spare you want to delete.

4. Click **Delete Spares from This Array**.

The drive is now available for use in an array or as a spare.

5.4.3 Managing Global Spares

Global spares let you have one or more disk drives available for the reconstruction of redundant arrays (mirrored [RAID 1 and RAID 10] and parity [RAID 3, RAID 4, RAID 5, and RAID 50]). Once you assign a drive as a global spare, it is not available for use as an array member or as a dedicated spare.

If a drive in any redundant array fails, the EF2800 can use a global spare to reconstruct the array. If a global spare is too small (smaller than an individual member in an array), the array cannot use it.

5.4.3.1 Adding a Global Spare

You can add up to eight drives as global spares to reconstruct any critical array on the EF2800. After an array has started using a global spare, other critical arrays are prevented from using it. For a global spare to be used, it must be as large as the smallest drive in the array.

To add a global spare:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Global Spare Menu** > **Add Global Spare**. The Add Global Spare page

displays listing all available drives. If a drive was a member of an array and was removed from the array, you cannot use it as a spare until you clear the drive's metadata. For more information, refer Section G.1.2, "Clearing Metadata from a Drive" on page 288.

2. Select the drive you want to add as a global spare.

3. Click **Add Global Spares**.

5.4.3.2 Deleting a Global Spare

You can delete a global spare at any time...

To delete a global spare:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Global Spare Menu** > **Delete Global Spare**. The Delete Global Spare page displays listing all global spares.

2. Select the global spare you want to delete.

3. Click **Delete Global Spares**.

5.4.3.3 Displaying Global Spares

You can display a list of all global spares.

To display global spares:

- From SAM, select **Manage EF2800** > **Disk Array Config** > **Global Spare Menu**. The Show Global Spare page displays listing all global spares

6

RAID Management

6.1 Managing Arrays and Partitions Using SAM

Using SAM, you can manage arrays and partitions. You can perform the following array-related functions:

- Manage arrays
  - View array and drive status (see page 88)
  - View and reset array statistics (see page 89)
  - Verify an array (see page 91)
  - Change array owner (see page 92)
  - Change the array name (see page 93)
  - Trust an array (see page 93)
  - Delete an array (see page 95)
- Manage partitions
  - View partition status information (see page 96)
  - Change a partition name (see page 96)
  - Change a partition LUN (see page 97)
  - Control partition access (see page 98)
  - Change a partition's read-ahead cache size (see page 103)
  - Delete a partition (see page 104)

6.2 Managing Arrays

SAM lets you manage your arrays in a variety of ways. You can:

- View array and drive status (see page 88)
- View and reset array statistics (see page 89)
- Verify an array (see page 91)
- Change array owner (see page 92)
- Change the array name (see page 93)
- Trust an array (see page 93)
- Delete an array (see page 95)

6.2.1 Viewing Array and Drive Status Information

Array status information is available from many pages in SAM. The top panel on all "Disk Array Config" and "LUN Management" pages displays an icon for each array with information about the array below it.

In this top panel, critical arrays display a blinking, red, and exclamation mark through the array. If a utility is running on the array, the percentage of completion is displayed. If any array is critical for any reason other than initializing or reconstructing, you should review the status information and take the appropriate action, such as replacing a disk drive.

More detailed array and drive information is available from three pages (for information about the fields on each page, click the **Page Help** icon):

- **Monitor EF2800** > **Status** > **Storage Array Status**—includes status information for the selected array and its disk drives and partitions.
- **Manage EF2800** > **Disk Array Config**—includes array status information for the selected array.
- **Manage EF2800** > **Disk Array Config** > **Disk Drive Status**—includes disk drive status information for the selected array.

6.2.2 Viewing Array and Partition Statistics

You can view the current array and partition rate and cumulative statistics. The following statistics are available:

- Rate statistics
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)
- Cumulative statistics
  - Number of read operations
  - Number of write operations
  - Number of sectors (512 bytes) read
  - Number of sectors written
  - Current command queue depth for each host port
  - I/O size for each host port
  - Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two.

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of an array and partition, which could be used to determine if additional arrays would increase performance and what RAID level is applicable to your needs. You may want to analyze the performance of the same application using different RAID levels to determine which level gives you the best performance. See Appendix B, "Array Basics" on page 185 for more details on RAID levels.

NOTE: The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

To view the rate statistics:

- From SAM, select **Monitor EF2800** > **Statistics** > **Partition Rate Stats**.

To view the cumulative statistics:

- From SAM, select **Monitor EF2800** > **Statistics** > **Cumulative Part Stats**.

6.2.2.1 Resetting All Statistics

You can reset the following array and partition statistics to zero:

- Read
- Write
- SecRd
- SecWt
- I/O Size

NOTE: Resetting statistics here resets all statistics for the EF2800.

You may want to reset the statistics if you are monitoring performance. You may also want to reset statistics when you change how you are using a partition.

NOTE: You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset all statistics:

1. From SAM, select **Monitor EF2800** > **Statistics** > **Reset All Statistics**. The Reset All Statistics page appears.
2. Click **Reset Statistics**. The system prompts for confirmation.

6.2.3 Verifying an Array

The Verify function allows you to verify the data on redundant arrays (RAID 1, RAID 3, RAID 4, RAID 5, RAID 10, and RAID 50):

- RAID 3, RAID 4, RAID 5, and RAID 50: Verifies all parity blocks in the selected array and corrects any bad parity
- RAID 1 and RAID 10: Compares the primary and secondary drives. If a mismatch occurs, the primary is copied to the secondary

You may want to verify an array when you suspect there is a problem.

To verify an array:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Verify Array**. The Verify Array page displays with a list of existing arrays.
2. Select the array you want.
3. Click **Verify & Update Array Parity**.

Verification begins and the percentage of verification completed displays. You can continue to use the array during verification.

To check the progress of the verification, select **Manage EF2800** > **Disk Array Config > Array Utility Progress** or any item from the Disk Array Config menu. The status of the verification displays in the list of arrays.

6.2.3.1 Stopping the Array Verification Process

You can stop the array verification process.

NOTE: If you stop the verification process, you cannot resume. You must restart from the beginning.

To stop the array verification process:

1. From SAM, select **Manage EF2800 > Disk Array Config > Abort an Array Utility**. The Abort an Array Utility page displays with a list of existing arrays.
2. Select the array you want.
3. Click **Abort Array Verification**.

6.2.4 Changing Array Ownership

You can change the ownership of any array between the SMs. When you create an array, SAM automatically selects the owner and balances the number of arrays each SM owns. You can select the array owner when you create an array by clicking **Advanced Options** from the third Create Array page.

In most situations, which SM owns the array does not matter. A single SM owns arrays and dedicated spares. When a SM fails, the other SM assumes temporary ownership of its resources.

NOTE: When you change the ownership of an array, the LUNs assigned to the array's partitions become invalid. After changing ownership, you must assign a new LUN to each array partition.

To change array ownership:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Change Array Owner**. The Change Array Owner page displays with a list of existing arrays.
2. Select the array you want.
   The Change Array Owner drop-down list shows the current owner.
3. Select the other SM from the drop-down list.
4. Click **Change Array Owner to Storage Manager X** (*where X is the other SM*).
5. Assign a new LUN to each array partition.
   See section 6.3.3, "Changing a Partition LUN" on page 97.

6.2.5 Changing an Array Name

You can change the name of an array. This does not affect the target ID or LUN values of the array. The EF2800 does not allow you to change an array name when a utility is running.

To change an array name:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Change Array Name**.
   The Change Array Name page displays with a list of existing arrays.
2. Select the array you want.
3. Enter a new name.
   You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (").
4. Click **Change Array Name**.

6.2.6 Trusting an Array

You can use the Trust Array function to bring an array back online by re-synchronizing the time and date stamp and any other metadata on a bad disk. This makes the disk an active member of the array again. You might need to do this when:

- One or more disks of an array start up more slowly or were powered on after the rest of the disks in the array. This causes the date and time stamps to differ, which the EF2800 interprets as a problem with the “late” disks. In this case, the array will function normally after using Trust Array.
- An array is offline because a drive is failing, you have no data backup, and you want to try to recover the data from the array. In this case, the Trust Array function may work, but only as long as the failing drive continues to operate.

Before you can use this function, you must enable it as described below.

CAUTION: The Trust Array feature can cause unstable operation and data loss if used improperly. This feature is intended for disaster recovery.

To trust an array:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**.
   The Option Configuration page displays.
2. For Enable Trust Array, select Enabled.
3. Click **Change Options**.
   The option is only enabled until you use it. After you trust an array, the option reverts back to being disabled.
4. Select **Disk Array Config** > **Trust Array**.
   The Trust Array page displays with a list of existing arrays.
5. Select the array you want.
6. Click **Trust This Array**.
   The array will be back online.

NOTE: If the array does not come back online, it may be that too many members are offline or the array may have additional failures on the bus or enclosure that Trust Array cannot fix.

6.2.7 Deleting an Array

You can delete an array when you no longer need the array or you need the drives for another use.

CAUTION: Deleting an array deletes all partitions and data contained in the array.

NOTE: You cannot delete an array while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the array.

To delete an array:

1. From SAM, select **Manage EF2800** > **Disk Array Config** > **Delete an Array**.
   The Delete an Array page displays with a list of all existing arrays.
2. Select the array you want to delete.
3. Click **Delete This Array**.
   The system asks you to confirm the deletion.
4. Click **OK**.

6.3 Managing Partitions

The SAM software lets you manage partitions in a variety of ways. You can:

- View partition status information (see page 96)
- Change a partition name (see page 96)
- Change a partition LUN (see page 97)
- Control partition access (see page 98)
- Change a partition's read-ahead cache size (see page 103)
- Delete a partition (see page 104)

6.3.1 Viewing Partition Status Information

Partition status information is available from many pages in SAM. The top panel on all **Disk Array Config** and **LUN Management** pages displays an icon for each array with information about the array below it.

In this top panel, critical arrays display a blinking, red exclamation mark through the array. If a utility is running on the array, the percent complete displays. If any array is critical for any reason other than initializing or reconstructing, you should review the status information and take the appropriate action, such as replacing a disk drive.

More detailed partition information is available from two pages (for information about the fields on each page, click **Page Help**):

- **Monitor EF2800** > **Status** > **Storage Array Status**—includes partition information for the selected array.
- **Manage EF2800** > **LUN Management**—includes more detailed partition information and a graphical depiction of the partitions for the selected array.

6.3.2 Changing a Partition Name

You can change the name of a partition. This does not affect the target ID or LUN values of the partition. You cannot change a partition name when a utility is running.

To change a partition name:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Change Partition Name**.
   The Change Partition Name page displays with a list of all existing arrays.
2. In the Select an Array to View LUN Information panel, select the array whose partition you want to rename.
3. In the Partition Menu panel, select the current partition name.
4. In the Change Name panel, enter the new name.
   You can use up to 20 characters. You can use any character on your keyboard (any printable ASCII character), except double quotes (").
5. Click **Change Partition Name**.

6.3.3 Changing a Partition LUN

You can change the LUN assigned to a partition, as it appears under the EF2800's target ID from the host system's point of view. The change takes place immediately, however, you may need to restart the host system to see the partition at the new LUN.

NOTE: You cannot change the partition's LUN to one that is already in use. If you want to use a LUN that is already in use, you must first reassign the LUN in use.

For more information about LUNs and your EF2800, see section H.4, "Understanding LUNs and Viewing LUN Information" on page 305.

To change a partition LUN:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Change Partition LUN**.
   The Change Partition LUN page displays with a list of all existing arrays.
2. In the Select an Array to View LUN Information panel, select the array whose partition you want to assign a new LUN.

3. In the Partition Menu panel, select the partition name.

4. In the Change LUN panel, select a new LUN.

5. Click **Change Partition LUN**.

6.3.4 Controlling Partition Access

The EF2800's InfoShield capability lets you specify which hosts can access each partition. This gives you complete control of array access based on your specific needs.

Figure 56 shows an example of how you can use InfoShield.

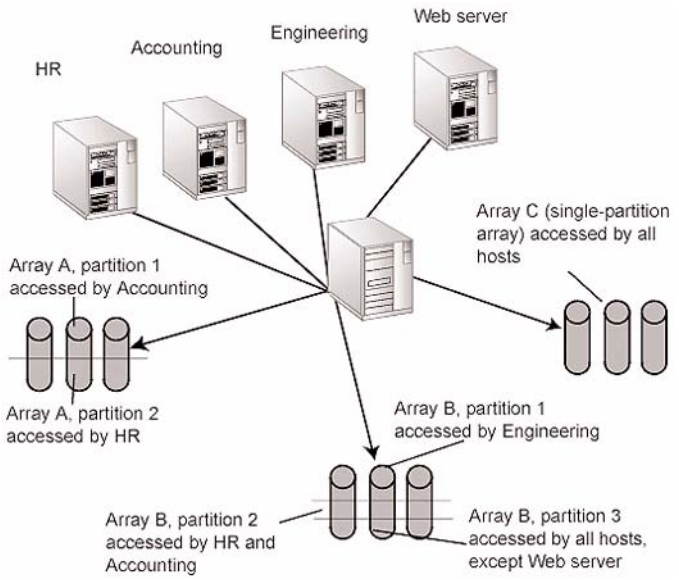
Web server
Engineering
Accounting
HR
Array C (single-partition array) accessed by all hosts
Array A, partition 1 accessed by Accounting
Array A, partition 2 accessed by HR
Array B, partition 1 accessed by Engineering
Array B, partition 2 accessed by HR and Accounting
Array B, partition 3 accessed by all hosts, except Web server

Figure 56. InfoShield Example

Before you set up InfoShield, you should know the World Wide Name (WWN) for each host that you want to set up. Your SAN administrator should know the WWNs for your network. You can display a list of the last 64 WWNs that the EF2800 is aware of on the SAN, and you can give each WWN a nickname of your own. This makes working with the InfoShield feature faster and easier.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 64 specific hosts or all hosts for each partition LUN.

For example, in Figure 56, Array A has two partitions. Partition 1 has an include list that contains only Accounting, so only the Accounting server can access partition 1. Array B, partition 3 has an exclude list that contains only the Web server, so all hosts *except* the Web server can access the partition. Array C uses the default setting, Include All Hosts, which permits all hosts to access the array.

6.3.4.1 Viewing Known WWNs

You can view the global host list, which includes the last 64 host WWNs that the EF2800 is aware of on your SAN. The EF2800 will be aware of any host that was started since the EF2800 was last restarted. Typically, hosts scan for devices during their start-up process. When this happens, the EF2800 saves the WWN information for the host, but does not retain the information after you restart the EF2800 unless you have given the host a nickname. The list includes the last 64 hosts that started or that you gave a nickname.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, then viewing the WWN list. The host that scanned for devices most recently is first on the list. You can then give the hosts nicknames you recognize. For example, you can use the computer name that has already been assigned to each host, to make InfoShield easier to manage.

To view known WWNs:

- From SAM, select **Manage EF2800** > **LUN Management** > **Manage Global Host List**.

  The Manage Global Host List page displays with a list of known host WWNs and nicknames you have given them. The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.

NOTE: A host's WWN is placed at the top of the known hosts list whenever the host performs a device discovery or bus scanning type of operation.

6.3.4.2 Creating Nicknames for Host WWNs

You can give the hosts on your SAN nicknames that you can easily recognize to make InfoShield easier to manage. For example, you can use the computer name that has already been assigned to each host. The list of known host WWNs and nicknames is called the global host list.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, then viewing the WWN list. The host that scanned for devices most recently is first on the list.

You can give nicknames to up to 64 hosts.

To add or change nicknames for WWNs:

1. From SAM, select **Manage EF2800 > LUN Management** > **Manage Global Host List**.
   The Manage Global Host List page displays with a list of known host WWNs and nicknames you have given them. The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.

2. To add a new host that is not listed:
   - In the Add Host to Global List panel, enter the WWN and nickname. Your SAN administrator should know the WWNs for your network. You can enter up to 15 characters. You can use only letters, numbers, and underscores.
   - Click **Add New Host**.

3. To change a host nickname that is listed:
   - In the Global Host List panel, enter a new nickname for the host you want to change. You can enter up to 15 characters. You can use only letters, numbers, and underscores.
   - Click **Change Host Nickname**.

6.3.4.3 Configuring InfoShield

Once you set up host nicknames, you can easily set up your InfoShield. This is where you determine which hosts can access each partition LUN.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 64 specific hosts or all hosts for each partition LUN.

The InfoShield information is stored as part of the array's metadata using the WWN for each host. If you install a new SM, the array partition's InfoShield will remain. The InfoShield will also remain if you change the partition's LUN.

NOTE: Changes to InfoShield take effect immediately, therefore, you should make changes that limit access to partitions when the partitions are not in use.

To set up InfoShield:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Partition Menu** > **InfoShield**.
   The InfoShield page displays.
2. In the Select an Array to View/Change InfoShield Information panel, select the array whose partition you want to control access to.
3. In the Select a Partition to View/Change InfoShield Information panel, select the partition name.
4. In the InfoShield Type for Array panel, select the InfoShield type you want to use and click **Change InfoShield Type**.

The panel shows the current InfoShield type in the drop-down list. The default setting for each partition LUN is Include All Hosts. This results in all hosts being able to access all partitions. Changing the InfoShield type does not add or remove any hosts in previously created lists.

- Include All Hosts: Permits all hosts on the network to access the selected partition. This is the default InfoShield type. This results

in all hosts being able to access the partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

- Include Listed Hosts: Lets you enter or select the WWNs of the specific hosts you want to be able to access the selected partition. The list of WWNs and nicknames that displays contains the last 64 hosts that started or that you gave a nickname. If you know other WWNs or nicknames, you can enter the WWN or nickname.

- Exclude All Hosts: Permits no hosts on the network to access the selected partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.

- Exclude Listed Hosts: Lets you enter or select the WWNs or nicknames of the specific hosts you do ***not*** want to be able to access the selected partition. The list of WWNs and nicknames that displays contains the last 64 hosts that started or that you gave a nickname. If you know other WWNs or nicknames, you can enter the WWN or nickname.

  Whether you use an include or exclude list depends on your needs. You may want to determine which list would be shorter and create the shorter list.

5. If you selected **Include Listed Hosts** or **Exclude Listed Hosts**, you must create a host list.

All hosts already on an include or exclude this for the partition are listed in the Host Table for Array panel. You can change a host nickname or delete a host from the list.

To add a host that is already on the global host list, select the host in the Add Existing Host for Array panel and click **Add Existing Host**. For more information about the global host list, see Section 6.3.4.2 on page 100.

To add a host that is not already on the global host list, enter the host WWN and nickname in the Add New Host for Array panel and click **Add New Host**.

6.3.5 Changing the Read-Ahead Cache Size

You can change the read-ahead cache size for each partition. This setting controls how much data the SM reads ahead and stores in its cache memory during sequential reads.

If you want to change this size, you should be prepared to monitor the system performance using the array statistics and adjust the size until you find the optimal size for your application.

The default setting is one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the array (default is 64 KB). The SMs treat volumes and mirrored arrays (RAID 1) internally as if they have a stripe size of 64 KB, even though they are not striped.

If you specify a read-ahead cache size, that amount of data is read first, and the same amount is read for all read-ahead accesses.

Read-ahead is triggered by two back-to-back accesses to consecutive logical block address (LBA) ranges. Read-head can be forward (that is, increasing LBAs) or reverse (that is, decreasing LBAs).

Setting the read-ahead size to 0 turns off read-ahead cache. This is useful if the host is triggering read-ahead for what are random accesses. This can happen if the host breaks up the random I/O into two smaller reads, triggering read-ahead. You can use the partition statistics read histogram to determine what size accesses the host is doing.

Setting the read-ahead size to a very large size (say four to five stripes) can help improve the performance of multiple (three or more) sequential read streams, in some cases improving performance by three times. This would be useful for providing multiple video streams, for example.

To change the read-ahead cache size:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Partition Menu** > **Read Ahead Cache**.
   The Read Ahead Cache page displays with a list of all existing arrays

2. In the Select an Array to View LUN Information panel, select the array whose partition you want to assign a new read-ahead cache size.
3. In the Partition Menu panel, select the partition name.
4. In the Partition Read Ahead Size panel, select the size you want. The current size displays in the drop-down list with ** next to it.
5. Click **Set Read Ahead Cache Size**.

6.3.6 Deleting a Partition

You can delete a partition when you no longer need it and you want to use the space for another purpose.

CAUTION: Deleting a partition deletes all data contained in the partition.

NOTE: You cannot delete a partition while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the partition.

To delete a partition:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Partition Menu** > **Delete Partition**.
   The Delete Partition page displays with a list of all existing arrays.
2. In the Select an Array to View LUN Information panel, select the array whose partition you want to delete.
3. In the Partition Menu panel, select the partition name.
4. Click **Delete Partition**.

7

Monitoring System Status

You should monitor your system regularly to ensure that the EF2800 enclosure, disk drives, and arrays are working properly. The EF2800 and SAM let you monitor the status several ways:

- EF2800 LEDs (see section 2.9, "Status LED Indicators" on page 38)
- SAM status pages (see page 105)
- Event log (see page 108)
- Remote notification (see page 110)
- All log information (see page 112)
- Overall and cumulative statistics (see page 113)
- Debug log (see page 170)

7.1 Displaying SAM Status Information

SAM includes many status pages that let you monitor the status of every aspect of the EF2800, arrays, and disk drives. Figure 57 lists the pages (the page name is also the menu item to select from the **Monitor EF2800** > **Status** menu) and the type of information on each page. View the page help for more information about each page. You may have to scroll down to see the Page Help link.

Figure 57. SAM Status Pages

Page	Information on the page
Status Summary	First page you see when you log in to SAM. Displays: Status message telling you the status of the two SMs. Array overview showing each existing array. Critical arrays display a blinking, red exclamation mark through the array. Click an array icon to go to the Storage Array Status page. EF2800 hardware status overview. Click a module name to go to the Module Status page.
Chassis View	Displays graphical representations of the front and rear of the EF2800. Failed modules display in red. Click a failed module for more information about the failure and module status.
Storage Array Status	Displays icons for each existing array with more detailed information about the selected array, such as RAID level, size, and disk drives. For more information about the array icons, see section 5.2.1 on page page 74.
FC Port Status	Displays a graphical representation of the LRC I/O modules on the rear of the EF2800 including a color-coded status of each port. Click a port for more information about that port.
Display All Devices	Displays information for all devices connected to the EF2800, including disk drive status, size, and array status.
FC Device Loop ID Map	Displays the FC device loop IDs in the order discovered on the loop.
LAN Information	Displays the Media Access Control (MAC) and IP address for each SM along with Telnet and SNMP settings.
Module Status	Displays status information about each EF2800 module, including details of the module status.
EF2800 Versions	Displays the software, hardware, and other version information for each SM.
Monitor EF2800 > Status > Environmental Status	
Temperature Status	Displays temperature status information for both SMs.
Fan/Battery Status	Displays fan status for all fans in the Power Ports and Power Managers and battery status for both SMs.
Power Status	Displays power status for all power supplies and AC/DC power.

Figure 57. SAM Status Pages (Continued)

Page	Information on the page
LUN Information	Displays node WWN and LUN information for each array plus the management LUNs assigned to each SM.
Misc Configuration	Displays the status of the following EF2800 settings: audio alarm, backoff percent, utility priority, battery, cache lock, dynamic spare, disk write-back cache, SMART, internal hubs, EMP, and security. Also displays the following for each SM: operation mode, active-active status, and write-back cache status.
View Event Log	Displays EF2800 events. See section 7.2 on page 108.

Figure 58 lists the pages available from the **Manage EF2800** > **Utilities** menu (the page name is also the menu item to select) and the type of information on each page.

View the page help for more information about each page. You may have to scroll down to see the Page Help link.

Figure 58. SAM Status Pages from the Manage EF2800 Menu

Page	Information on the page
Manage EF2800 > Utilities > Audit Menu	
Audit Risky Settings	Displays several categories of potentially risky settings that may cause problems and is useful in troubleshooting an EF2800 Subsystem that is not operating correctly.
Audit Fault Tolerance	Displays several categories of settings that may affect the fault tolerance of your EF2800.
Audit Performance	Displays several categories of settings that may affect the performance of your EF2800.
Audit Security	Displays several categories of settings that may affect the security of your EF2800.
Audit Troubleshooting	Displays several common setting problems that can cause operational issues.

Figure 58. SAM Status Pages from the Manage EF2800 Menu

Page	Information on the page
Manage EF2800 > Utilities > Debug Utilities	
View Debug Log	Displays debug information and the messages you select in the Debug Log Configuration page.
View Error Buffers	Displays error buffer information from the LAN Subsystem.
View CAPI command trace	Displays a history of the CAPI commands sent to and received from the LAN Subsystem.

7.2 Displaying the Event Log

The EF2800's event log contains important information about the status of the EF2800, arrays, and disk drives. You should check it regularly to monitor the status of your system. For more information about specific warning and error events and specific disk and port errors, refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141.

Below is a list of some of the key warning and error events included in the event log during operation:

- Disk detected error
- Disk channel error
- Battery failure
- Drive down
- Array critical
- Array offline
- Temperature warning
- Temperature failure (this leads to a shutdown which is also logged)
- Voltage warning
- Voltage failure (this leads to a shutdown which is also logged)

The event log stores the most recent events with a time stamp next to them with one-second granularity.

NOTE: If you are having a problem with the EF2800 or an array, check the event log before calling technical support. Event messages may let you resolve the problem without calling. You should also refer to Chapter 10, "Troubleshooting and Problem Solving" on page 141.

You can view the event information four ways by clicking the buttons at the top of the Event Log page:

- All events for both SM modules (up to 400 events)
- Events for just SM module A (up to 200 events)
- Events for just SM module B (up to 200 events)
- Only error events (includes only warning and error events)

You can also save the event log to a file (see Section 7.4 on page 112).

To view the event log:

1. From SAM, select **Monitor EF2800** > **Status** > **View Event Log** or click the Event Log link near the bottom of every SAM page. The Event Log page displays with the combined event table (Figure 59).

2. Click a button at the top of the page for the view of the event log you want.

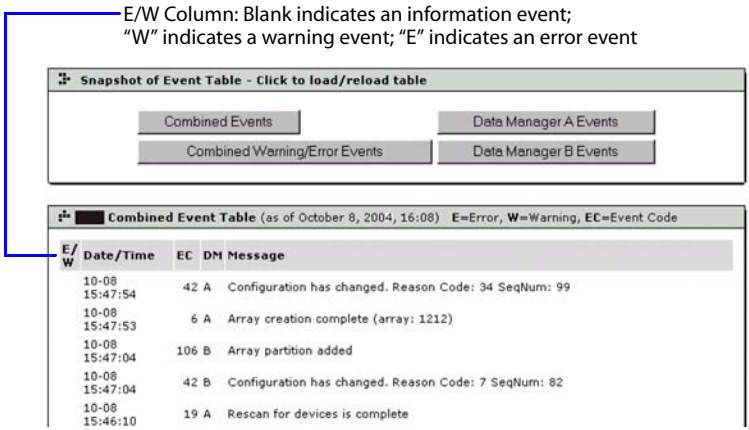

Figure 59. SAM - Event Log Screen

7.3 Setting Up Remote Notification

Remote notification lets you receive information about specific EF2800 events by email. You can select the types of events and up to four email addresses. You can view the current settings by selecting **Manage EF2800** > **Remote Configuration**.

Remote notification requires that you set up two items:

- Events to be monitored
- Email addresses to send events to
  - By category
  - By specific event

7.3.1 Starting and Stopping Remote Notification

You can start or stop remote notification at any time. If you start remote notification, be sure to select event categories or specific events to monitor.

To start or stop remote notification:

1. From SAM, select **Manage EF2800** > **Remote Configuration** > **Event to be Monitored**. The Current Settings page appears.
2. Select whether you want to start or stop remote notification.
3. Click **Change Notification**.

7.3.2 Setting Up the Events to be Monitored

You can select the events you want to monitor using remote notification in two ways:

- By category
- By specific event

You can combine the event selections in any way that meets your needs. When one of these events occurs on the EF2800, SAM sends a message to the e-mail addresses that you have set up.

To set up events:.

1. From SAM, select **Manage EF2800** > **Remote Configuration** > **Select Event Categories**. The Select Event Categories page displays.
2. Select which event categories, if any, you want to trigger an e-mail message.
3. Click **Change Monitored Event Categories**.
4. Select **Manage EF2800** > **Remote Configuration** > **Select Specific Categories**. The Select Specific Events page displays.
5. Select the specific events, if any, you want to trigger an email message. Use the buttons at the bottom of the page to select or clear all events.
6. Click **Change Individual Monitored Events**.

7.3.3 Setting Up the Email Addresses

You can send events to up to four e-mail addresses for remote notification. You can also test the e-mail setup by clicking **Send Test E-mail**.

To set up e-mail addresses:

1. From SAM, select **Manage EF2800** > **Remote Configuration** > **E-mail Configuration**. The E-mail Configuration page displays.
2. Enter the following information:
   - E-Mail Address 1 through 4: Enter up to four email addresses you want to receive notification of EF2800 events. Enter the addresses in the format: user_name@domain_name.
   - E-Mail Comment: Enter text that you want sent with email messages. For example, you might want to identify something about the location, name, or use of this EF2800 enclosure.
   - Mail Server: Enter the IP address of the SMTP server to use for the email messages. Contact your system administrator for more information.
   - Domain Name: For some networks, you need to enter the domain name. Contact your system administrator for more information.
   - Sender Name: Enter the EF2800's administrator's name.
3. Click **Change E-mail Info**.

7.4 Saving Log Information to a File

You can save EF2800 event and debug log information to a file. The file contains selected log information, including:

- Event log
- Diagnostic debug logs
- Device status

The device status information is always included.

You can enter contact information for inclusion in the log information file. This helps identify the issue and contact information when these logs are being collected for diagnostic purposes.

To save log information to a file:

1. From SAM, select **Manage EF2800** > **Debug Utilities** > **Save Log Files**. The Save Log Files page appears.
2. Enter any contact information you want to include in the log file. By doing so, your contact information and comments will help create a unique document that may be used to identify the issue and origin when these logs are being collected for diagnostic purposes.
3. Select the type of information you want to include in the log from the File Contents list.
4. Click **Generate Log Information** to save the current contact information, generate the requested information, and proceed to the log disposition page.
5. Click **Download Selected Logs to File** to save the logs to a file on the host system or anywhere accessible on your network.
6. When the File Download window displays, select **Save this file to disk** and click **OK**.
7. Navigate to where you want to save the file, enter the file name, and click **Save**. The Download Complete window displays.
8. Click **Close**.

7.5 Displaying Overall Statistics

You can display two types of aggregate statistics for all arrays:

- Rate statistics (for all arrays and each individual array):
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)
- Cumulative statistics for all arrays
  - Number of read operations
  - Number of write operations
  - Total sectors (512 bytes) read
  - Total sectors written
  - Total current command queue depth across all LUNs
  - Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two.

Similar statistics are also available for individual arrays and partitions. For more information, see section 6.2.2, "Viewing Array and Partition Statistics" on page 89.

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of an array, which could be used to determine if additional arrays would increase performance and what type of RAID level is applicable to your needs. You may want to analyze the performance of the same application using different RAID levels to determine which level gives you the best performance. See Appendix B, "Array Basics" on page 185 for more details on RAID levels.

NOTE: The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

To view the overall rate statistics:

- From SAM, select **Monitor EF2800** > **Statistics**

To view the cumulative statistics:

- From SAM, select **Monitor EF2800** > **Statistics > Cumulative Stats**.

7.5.1 Resetting the All Statistics

You can reset the following statistics to zero:

- Read
- Write
- SecRd
- SecWt
- I/O Size

NOTE: Resetting statistics here resets all statistics for the EF2800.

You may want to reset the statistics if you are monitoring performance. You may also want to reset statistics when you change how you are using the partition.

NOTE: You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset all statistics:

1. From SAM, select **Monitor EF2800** > **Statistics** > **Reset All Statistics**.
   The Reset All Statistics page displays.
2. Click **Reset Statistics**.
   The system confirms that you want to make the changes

8

Other EF2800 Configurations

SAM lets you configure settings and perform a variety of functions on the EF2800. You can:

- Configure the LAN-related settings (page 116)
- Change the date and time (see page 120)
- View LUN information (see page 120)
- Change management LUNs (see page 121)
- Change the alarm mute setting (see page 122)
- Lock the cache setting (see page 124)
- Enable or disable the battery (see page 124)
- Change the utility priority (see page 125)
- Rescan all ports (see page 126)
- Pause I/O (see page 126)
- Save and restore a configuration file (see page 127)
- Restore the default settings (see page 130)
- Update the software (see page 131)

8.1 Configuring the LAN-related Settings

You can configure several LAN-related settings for the EF2800:

- Telnet settings (see page 116)
- SNMP settings (see page 116)
- System information (see page 117)
- Passwords (see page 118)
- Security options (see page 119)
- IP settings

8.1.1 Configuring the Telnet Timeout

You can set the Telnet timeout setting, which controls the number of idle minutes before the Telnet session times out. The default is no timeout, which is shown as 0 minutes.

To set the Telnet timeout:

1. In SAM, select **Manage EF2800** > **General Config** > **LAN Configuration**. The LAN Configuration page displays.
2. In the Telnet Configuration panel, enter the timeout period.
3. Click **Change LAN Configuration**.

8.1.2 Configuring the SNMP Settings

You can set four Simple Network Management Protocol (SNMP)-related settings:

- Traps Enabled: On or off toggle to enable SNMP traps. The default setting is disabled.
- SNMP Trap Host: Host computer's IP address that is set up to receive SNMP traps. The default value is 0.0.0.0.
- Trap Filter: Informational, Warning, or Error. The default setting is Warning.

- Event Filter: Informational, Warning, or Error. The default setting is Warning.

To set the SNMP settings:

1. In SAM, select **Manage EF2800** > **General Config** > **LAN Configuration**. The LAN Configuration page displays.
2. In the SNMP Configuration panel, select the options you want.
3. Click **Change LAN Configuration**.

8.1.3 Configuring the System Information

You can set four system information settings:

- System Name: Name of the EF2800 as seen by other systems on the LAN. You can enter up to 74 characters. The default name is Uninitialized Name.
- System Contact: Name of a contact person responsible for the EF2800. You can enter up to 74 characters.
- System Location: Location of the EF2800. You can enter up to 74 characters.
- System Information: Additional information about the EF2800. You can enter up to 74 characters.

To configure the system information:

1. In SAM, select **Manage EF2800** > **General Config**. The System Information page displays.
2. Enter the system information.
3. Click **Change System Configuration**.

8.1.4 Setting Passwords

You can set passwords for the following:

- Monitor User Password: These users only have access to the functions on the **Monitor EF2800** menu. The default password is “monitor”. Up to three monitor-only users can be logged in at a time. You can use up to 31 characters. You can use only letters, numbers, and underscores.
- Manage User Password: These users have access to all SAM functions. The default password is “manage”. Only one manage user can be logged in at a time. You can use up to 31 characters. You can use only letters, numbers, and underscores.
- Telnet User Password: Password for accessing the SM using the Ethernet port and Telnet. There is no default password (press <Enter>). You can use up to 15 characters. You can use only letters, numbers, and underscores.
- FTP User Login: Login name for FTP access to the SM. You can use FTP to download software updates. The default login name is “flash”. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- FTP User Password: Password for FTP access to the SM. The default password is “flash”. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- SNMP Read Community: SNMP read password. The default password is “Public”. You can use up to 15 characters. You can use only letters, numbers, and underscores.
- SNMP Write Community: SNMP write password. The default password is “Private”. You can use up to 15 characters. You can use only letters, numbers, and underscores.

To set SAM passwords:

1. From SAM, select **Manage EF2800** > **General Config** > **Passwords/ Security**. The Passwords/Security page appears.
2. In the Password Configuration panel, enter the passwords you want.
3. Click **Change**.

8.1.5 Configuring the Security Options

You can enable or disable the following LAN-related functions:

- FTP Capability: Controls access to the SMs using file transfer protocol (FTP), which permits you to upgrade the SM's LAN Subsystem software. The default setting is enabled.
- Telnet Capability: Controls access to the SMs using Telnet, which permits you to manage the SMs using your LAN. The default setting is enabled.
- HTTP: Controls access to the SMs using hypertext transfer protocol (HTTP), which permits you to manage the SMs using SAM. The default setting is enabled.
- SNMP Capability: Controls the availability of SNMP, which permits remote monitoring of the SM using your LAN. The default setting is enabled.
- Internet Debug: Used for diagnosing problems during the technical support process. We recommend that this remain disabled unless support personnel tell you to enable it. The default setting is disabled. You must restart both SMs for the change to take effect. Select Shutdown/Restart from the SAM menu.
- In-Band Management: Controls whether you can use the EF2800 Configuration Application Programming Interface (CAPI) to access the SM. Disabled means the SM does not have a management LUN assigned. Click the blue text to access the page where you can assign the management LUN.

To change any of the security options:

1. From SAM, select **Manage EF2800** > **General Config** > **Passwords/ Security**. The Passwords/Security page displays.
2. In the Security Configuration panel, select the options you want.
3. Click **Change**.

8.2 Changing the Date and Time

You can change the EF2800's date and time.

To set the EF2800's date and time:

1. From SAM, select **Manage EF2800** > **General Config** > **Set Date/ Time**. The Set Date/Time page displays.
2. In the Set EF2800 System Date panel, select the month, day, and year.
3. In the Set EF2800 System Time panel, enter time using a 24-hour clock. The Time Zone field controls the time stamp on e-mail messages sent for the Remote Notification function.
4. Click **Change Date/Time**.

8.3 Understanding LUNs and Viewing LUN Information

Each SM supports up to 64 FC logical unit numbers (LUNs), or 128 after a failover, that are numbered zero through 63. There are three different types of LUNs: management (also called CAPI), EMP, and partition. You can view information about each LUN, see section 8.3.1 on page 121.

The three types of LUNs have the following characteristics:

- Management (CAPI) LUN: Allows CAPI to configure the SM. Each SM can have a management LUN. You only need to assign a management LUN if you are using CAPI to configure the SM over a host port using SCSI protocol extensions. You are using CAPI only if your company has written a program to monitor and manage the EF2800. If you are not using CAPI, you can set the management LUN to "NONE". If you are using CAPI, you can set it to a value of 0-63.

NOTE: Most UNIX, Linux, and Macintosh operating systems require that the management LUN be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If you are using software that your company developed to configure and

manage the controller (this application uses CAPI to communicate with the controller), you must have a management LUN. If you are not using software that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0.

- EMP LUNs: Allow access to EMPs. You can set an EMP LUN to a value of 0-63 or NONE. NONE means that the EMP cannot be accessed via a LUN. For information about changing the EMP LUN, see section G.2.1, "Setting the EMP LUN" on page 294.
- Partition LUNs: Allow access to array partitions on the EF2800. You can set partition LUNs to any numeric value from 0-63. For information about changing the partition LUN, see section 6.3.3, "Changing a Partition LUN" on page 97.

8.3.1 Viewing LUN Information

You can view information for each existing LUN.

To view LUN information:

- From SAM, select **Monitor EF2800** > **Status** > **LUN Information**. The LUN Information page displays listing each existing LUN along with the node WWN, array name, and partition name.

8.4 Changing Management LUNs

Each SM has a management LUN (also called the CAPI LUN) that you can change. These LUNs allow the SM Configuration Application Programming Interface (CAPI) to configure the SMs. You need to assign a management LUN only if you are using CAPI to configure the SM over a host channel using SCSI protocol extensions. If you are not using CAPI, you can set the management LUN to “NONE”. If you are using CAPI, you can set it to a value of 0-63.

NOTE: Most UNIX, Linux, and Macintosh operating systems require that the management LUN be set to a higher value than all array LUNs. Before creating your first array, change the management LUN to a higher value. If

you are using software that your company developed to configure and manage the controller (this application uses CAPI to communicate with the controller), you must have a management LUN. If you are not using software that your company developed, and therefore are not using CAPI, select NONE as the management LUN. This allows your first array to be seen at LUN 0.

To change the management LUNs:

1. From SAM, select **Manage EF2800** > **LUN Management** > **Change SM LUN**. The Change SM LUN page displays.
2. Select the LUN you want to use for each SM:

   Note: Use this setting if you are not using CAPI to configure the EF2800.

   Any number between 0 and 63: Select a specific number if you want the management LUN to stay the same when you restart the EF2800 (this change takes effect following a shutdown reboot).
3. Click **Change Management LUN**.

8.5 Changing the Alarm Mute Setting

You can enable or disable the audible alarm that sounds when the EF2800 becomes too hot, detects low or high voltage, or an array becomes critical or goes offline. Changing the mute setting lets you turn off the alarm when it is sounding. You should turn it back on after resolving the problem.

You can also use the Mute button on the EF2800 to turn off the alarm when it sounds.

The alarm sounds for temperature or voltage conditions (events). Warning events are generated when the temperature or voltage enters the warning range. Shutdown events are generated when the temperature or voltage enters the shutdown range. After reaching the shutdown range, the EF2800 will not function. You must resolve the problem and restart the EF2800. If the problem is not resolved, it will shut down again.

Alarm conditions trigger an event message that displays in the event log.

Figure 60 shows the temperature and voltage thresholds for each alarm and how to resolve the problem.

Figure 60. Alarm thresholds

Alarm threshold	What to do when the alarm sounds
EF2800 internal temperature • Warning: 0°C to 4°C and 66°C to 70°C • Shutdown: <0°C and >70°C	• Check SAM to confirm what the alarm means by clicking **Event Log** on any page. • Check the ambient temperature and lower it, if needed. Ambient temperature should be less than 40°C. • Check that the EF2800 has good airflow clearance.
SM CPU temperature • Warning: 0°C to 4°C and 91°C to 100°C • Shutdown: <0°C and >100°C	• Same as above.

To enable or disable the alarm:

1. From SAM, select **Manage EF2800** > **General Config** > **Audio Alarm**. The Audio Alarm page displays.
2. Select the alarm option you want.
3. Click **Change Configuration**.

8.6 Controlling Host Access to EF2800's Write-back Cache Setting

You can prevent host systems from using SCSI mode-select commands to change the EF2800's write-back cache setting. Some operating systems disable write cache. If cache lock is enabled, the host cannot change the cache setting. The default setting is disabled.

This option is useful in some environments where the host system disables the EF2800's write-back cache, resulting in degraded performance.

To lock the cache setting:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**. The Option Configuration page displays.

2. Select the Host Control of Write-back Cache option you want.

3. Click **Change Options**.

8.7 Enabling and Disabling the Battery

If you are not using a battery in your EF2800, the system alarm will be activated. To eliminate the alarm, you can disable the battery. The default setting is "battery enabled".

Notes:

- *You should only disable the battery if you are running the EF2800 with an Uninterruptible power supply (UPS), so that you will not lose power to the EF2800.*

- *If you disable the battery, the EF2800 will **not** give any warnings, nor will it disable the write-back cache.*

- *If you change this setting, you must restart the EF2800 for the change to take effect.*

To change the battery setting:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**. The Option Configuration page displays.
2. Select the Battery option you want.
3. Click **Change Options**.
4. You must restart the EF2800 for the change to take effect. Select **Shutdown/Restart** from the SAM menu.

8.8 Changing the Utility Priority

You can change the priority at which all utilities (Verify, Reconstruct, Expand, and Initialize) run when there are active I/O operations competing for the EF2800's CPU. The choices are:

- High (default)
- Medium
- Low

For example, select High if your highest priority is to get the array back to a fully fault-tolerant state. This causes heavy I/O with the host to be slower than normal. Select Low priority if streaming data without interruption, such as for a Web server, is more important than data redundancy. This allows the Reconstruct or other utility to run at a slower rate with minimal effects on host I/O.

To change the utility priority:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**. The Option Configuration page displays.
2. Select the Utility Priority option you want.
3. Click **Change Options**.

8.9 Rescanning All Ports

You can tell the EF2800 to scan all disk ports for new or removed disk drives. You can use this option when you install or remove disk drives. The rescan temporarily pauses all I/O processes, then resumes normal operation.

If you are using an enclosure with an EMP, the EF2800 performs a rescan automatically. With an EMP, the EMP detects the change in drive status and updates the EF2800 about removed drives almost immediately; however, installed drives will be detected after a three-minute delay. This delay is to allow the new drives to spin up.

To rescan all ports:

1. From SAM, select **Manage EF2800** > **Utilities**. The Rescan page displays.
2. Click **Rescan**.

8.10 Pausing I/O

Most drive enclosures allow you to remove and replace drives while FC device port activity continues. However, you may still want to pause I/O if you are replacing more than one disk drive. The Hot Swap Pause option suspends activity on all device channels used in the EF2800, thereby ensuring data integrity on the connected drives and arrays.

CAUTION: Pausing I/O halts active I/O to the host.

NOTE: If you are not sure that your JBOD enclosure supports hot swapping, use the Hot Swap Pause option before you remove or replace any drives in an array.

To pause I/O:

1. From SAM, select **Manage EF2800** > **Utilities** > **Hot Swap Pause**. The Hot Swap Pause page displays.

2. Click **Pause**.

3. When you have replaced the drive, resume I/O activity by clicking **Unpause**.

CAUTION: Do not stay in the Hot Swap Pause mode for too long; otherwise, an operating system time-out may occur (the time varies according to the operating system). For example, in Windows NT, the default limitation during I/O activity is 10 seconds.

8.11 Saving and Restoring a Configuration File

You can save all of your EF2800 configuration settings to a file and restore that file.

8.11.1 Saving a Configuration File

You can save all of your EF2800 configuration settings to a file. This lets you make a backup of your settings. The configuration file contains all EF2800 configuration information including the following settings:

- FC host port
- FC device port
- Enclosure management
- Options
- Disk
- LAN
- Audio alarm
- Passwords/security
- Remote notification

NOTE: A configuration file does not include any array or partition information.

To save a configuration file:

1. From SAM, select **Manage EF2800** > **Utilities** > **Configuration Utilities** > **Save Config File**. The Save Config File page displays.
2. Click **Save Configuration File** to save the current EF2800 configuration to a file on the host system or anywhere on your network. The File Download window displays.
3. Select **Save this file to disk** and click **OK**. The Save As window displays.
4. Navigate to where you want to save the file and enter the file name.
5. Click **Save.**

8.11.2 Restoring a Configuration File

You can restore a saved EF2800 configuration file. This lets you revert back to previous settings or "clone" one EF2800's settings to another EF2800. You must use SAM to connect to the EF2800 where you want to restore the file.

To restore a configuration file:

1. From SAM, select **Manage EF2800** > **Utilities** > **Configuration Utilities** > **Restore Config File.** The Restore Config File page displays.
2. Select the option you want:
   - Use Current IP Addresses: Restores the configuration file to the EF2800 that SAM is currently connected to and retains the currently assigned IP addresses. Use this to restore a backup configuration file to the current EF2800 without changing the IP addresses of the EF2800. This option ignores the IP addresses contained in the configuration file.
   - Use New IP Addresses: Restores the configuration file to the EF2800 SAM is currently connected to and changes the EF2800's IP addresses to what you enter here. Use this option to clone the EF2800 and change the IP addresses to what you enter. This option ignores the IP addresses contained in the configuration file. Enter the IP Address, Subnet Mask, and IP

Gateway for both SMs on the same EF2800. After the file is restored, you must reconnect to the EF2800 using one of the new IP addresses.

- Use Restore File IP Addresses: Restores the configuration file to the EF2800 that SAM is currently connected to and changes the IP addresses to those contained in the configuration file. Use this to restore a configuration file to the current EF2800 whenever the IP addresses in the configuration file are the IP addresses you want assigned to the EF2800. After the file is restored, you may need to reconnect to the EF2800 using one of the IP addresses from the file.

3. Click **Continue**. A new page displays. The information on the new page depends on your selection in the previous page.

4. If you chose the Use New IP Addresses option, enter the new IP addresses here and click **Continue Restore Process**.

5. Click **Browse** to navigate to the EF2800 configuration file on the host system or anywhere on your network. The Choose File window displays.

6. Navigate to the file and select it.

7. Click **Open**.

8. Click **Restore Configuration File**.

8.12 Viewing and Restoring Default Settings

You can view and restore all of the EF2800's default settings.

8.12.1 Viewing Default Settings

You can view the EF2800's default settings as well as the current settings.

To view the default settings:

- From SAM, select **Manage EF2800** > **Utilities** > **Configuration Utilities**. The Show Changed Settings page displays.

8.12.2 Restoring Default Settings

You may want to do this if the EF2800 is not working properly and you cannot determine why. This lets you then change the settings that are critical to your configuration.

You can also view all of your current settings and a compare them to the default settings.

Restore Defaults does not affect any settings related to arrays or partitions. This restores all configuration settings except:

- Management (CAPI) LUN
- IP settings (addresses, subnet mask, and gateway)
- Device port link speeds

To see a list of the current settings and the default settings, click the blue **See Restore Default Changes** text.

To restore the default settings:

1. From SAM, select **Manage EF2800** > **General Config** > **Restore Defaults**. The Restore Defaults page displays.
2. Click **Restore Defaults**.
3. You must restart the EF2800 for the change to take effect. Select **Shutdown/Restart** from the SAM menu.

8.13 Updating Software

You can update the EF2800 software from SAM using a software package file. Information regarding the latest release of software and software package files are available from your supplier.

SAM automatically updates only those types of software that require updating.

NOTE: You should always update the software on both Storage Manager modules. The update process puts the SM module offline during the update process, which takes about ten minutes for each SM module.

To update software:

1. From SAM, select **Manage EF2800** > **Utilities** > **Load Software**. The Load Software page displays, which describes the two-step update process and lists your current software versions.

2. Click **Browse** to select to the software package file you downloaded. The Choose File window displays.

3. Navigate to the software package file and select it.

4. Click **Open**. The Load Software page displays.

5. Click **Load Software Package File**.

   If the system finds a problem with the file, it displays a message at the top of the page. To resolve the problem, try the following:

   - Select the file again (be sure that you select the software package file that you downloaded from the Web site)
   - Download the file again, in case it got corrupted (do not attempt to edit the file)

   After about 30 seconds, the Load Software for EF2800 page displays. This page lets you know whether the file was validated and what software components are in the file. The system only updates the software that has changes.

6. If you want to force all of the software components to load, even if they have not changed, select the **Force load of all files even if versions match** option.

7. Click **Proceed with Code Update**.

   The update process takes about ten minutes to complete. SAM returns to the Load Software page when update is complete.

8. Connect to the other SM module and repeat the above steps.

9

Managing Disk Drives & Enclosures

SAM lets you control a variety of functions related to devices and enclosure management processor (EMP) enclosures connected to your EF2800.

- For devices, you can:
  - Display device information (see page 134)
  - Clear metadata from a disk drive (see page 135)
  - Enable or disable write-back cache (see page 135)
  - Display disk cache status (see page 136)
  - Enable or disable changes to SMART (see page 136)
  - Blink a drive LED (see page 137)
  - Take down a disk drive (see page 137)
  - Test a disk drive (see page 138)
- For EMP enclosures, you can:
  - Change the EMP LUN (see page 139)
  - Change additional EMP settings (see page 140)

9.1 Managing Disk Drives

SAM lets you control a variety of functions related to disk drives. You should also refer to your disk drive or JBOD enclosure documentation for information about related functions.

9.1.1 Displaying Disk Drive Information

You can display two types of information about disk drives:

- A list of all drives connected to the EF2800
- The status of all disk drives in an array

9.1.1.1 Displaying All Devices

You can display a list of all connected devices. For more information about the fields that display for each device, click **Page Help** near the bottom of the page.

Disk drives that are not members of any array are listed as Available. Drives that contain leftover metadata from a previous array are listed as Leftover. This situation can arise if drives are removed and reinserted or the drives failed temporarily and are not operating again. To clear leftover metadata, use the Clear Metadata function. See section G.1.2, "Clearing Metadata from a Drive" on page 288.

To display all disk drives:

- From SAM, select **Monitor EF2800** > **Status** > **Display All Devices**. The Display All Devices page displays, listing all connected devices.

9.1.1.2 Viewing Disk Drive Status

You can view the status of the drives in an array.

NOTE: If a disk drive has failed or malfunctioned, it may not be listed.

To view drive status:

1. From SAM, select **Manage EF2800** > **Status** > **Disk Drive Status**. The Disk Drive Status page displays listing all arrays.
2. Select the array whose disk drive status you want to see.

9.1.2 Clearing Metadata from a Disk Drive

All of the member disk drives in an array contain metadata in the first sectors. The EF2800 uses the metadata to identify array members after restarting or replacing SMs.

You can clear the metadata if you have a disk drive that was previously a member of an array. Disk drives in this state display Leftover in the Display All Devices page and in the Clear Metadata page. After you clear the metadata, you can use the disk drive in an array or as a spare.

To clear metadata from a disk drive:

1. From SAM, select **Manage EF2800** > **Utilities > Disk Drive Utilities** > **Clear Metadata**. The Clear Metadata page displays listing all available and leftover disk drives.
2. Select the disk drive whose metadata you want to clear.
3. Click **Clear Metadata from Selected Device**.
   You can now use this disk drive in an array or as a spare.

9.1.3 Enabling and Disabling Write-back Cache

You can control the write-back cache setting for all of your disk drives at once. Changes take effect after the next rescan or restart.

This can be set to Enable, Disable, or Don't Modify (which means the EF2800 should not change any disk drive's write-back cache settings). The default setting is Disabled.

Typically, if your disk drives are part of an array, you do not want to turn on their write-back cache. The EF2800 is already using write-back cache to improve performance. Turning on write-back cache on the disk drive *may* improve performance in some cases, depending on the type of array and how you are using it.

Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of power failure. If the disk drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk drive's write-back cache.

CAUTION: We recommend that you disable write-back cache on disk drives. Some disk drives delete their write-back cache if they encounter an internal error, resulting in lost data.

To change the write-back cache setting:

1. From SAM, select **Manage EF2800 > General Config** > **Disk Configuration**. The Disk Configuration page displays.
2. Select the Write-back Cache option you want.
3. Click **Change Disk Option Configuration**.
4. Select **Manage EF2800** > **Utilities** and click **Rescan** to have your changes take effect.

9.1.4 Displaying Disk Drive Cache Status

You can display the cache status of each disk drive. Any disk drives with write-back cache enabled should be connected to a UPS in case of power failure. If the disk drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

To display disk cache status:

1. From SAM, select **Manage EF2800** > **Utilities** > Di**sk Drive Utilities** > **Display Disk Cache**. The Display Disk Cache page displays.
2. Select the drive whose cache settings you want to see.

9.1.5 Enabling and Disabling SMART Changes

You can enable or disable the ability to change the Self-Monitoring, Analysis and Reporting Technology (SMART) settings for all disk drives connected to the EF2800. This can be set to Enable, Disable, or Don't Modify (which means the EF2800 should not change any disk drive's SMART settings). The default setting is Don't Modify.

When you enable SMART, the SMART events are recorded in the event log, which lets you monitor your disk drives or analyze why a disk drive

failed. On most disk drives, SMART is disabled by default by the manufacturer.

To enable or disable SMART changes:

1. From SAM, select **Manage EF2800** > **General Config** > **Disk Configuration**. The Disk Configuration page displays.
2. Select the SMART option you want.
3. Click **Change Disk Option Configuration**.
4. Select **Manage EF2800** > **Utilities** and click **Rescan** to have your changes take effect.

9.1.6 Blinking a Drive LED

You can blink the LED on a specific disk drive.

To blink a drive LED:

1. From SAM, select **Manage EF2800** > **Utilities > Disk Drive Utilities**. The Blink Drive LED page displays listing all devices.
2. Select the disk drive whose LED you want to blink.
3. Click **Blink Selected Device LED**. The disk drive continues blinking its LED until you click **Unblink Selected Device LED**.

9.1.7 Taking Down a Disk Drive

CAUTION: This function is only for testing and could result in data loss. It should not be used in normal operation.

The Down Drive function sets the status of a disk drive in a fault-tolerant array to down. This forces the EF2800 to remove it from the array and marks the array as critical. The downed disk drive is marked as Leftover and you cannot add it back to the array. You also cannot take down any additional disk drives in the array.

If you have a properly sized dedicated or global spare, this will cause a reconstruct on the affected array.

To take down a disk drive:

1. From SAM, select **Manage EF2800** > **Utilities** > **Disk Drive Utilities** > **Down Disk Drive.** The Down Disk Drive page displays listing all devices.
2. Select the disk drive you want to take down.
3. Click **Down Selected Drive**.

Before you can use the disk drive again, you must clear its metadata. See section G.1.2, "Clearing Metadata from a Drive" on page 288.

9.1.8 Testing a Disk Drive

This function issues a Test Unit Ready (TUR) command to the selected disk drive. This just tells you that the disk drive can respond, but it still may not be functioning properly.

To test a disk drive:

1. From SAM, select **Manage EF2800** > **Utilities** > **Disk Drive Utilities** > **Test Unit Ready**. The Test Unit Ready page displays listing all devices.
2. Select the disk drive you want to test.
3. Click **Test Unit Ready**.

   If the TUR was successful, Test Unit Ready STATUS OK displays. If the TUR was not successful, a failure message displays.

9.2 Managing Enclosures

An enclosure management processor (EMP) is a device in the enclosure from which the EF2800 can inquire about the enclosure's environmental conditions such as temperature, power supply and fan status, and the presence or absence of disk drives. The EF2800 can also tell the EMP about RAID activities such as disk drive rebuilds and failed disk drives.

If you have only one EMP, the configuration settings are automatically enabled when the EF2800 is installed. No changes are required to the default configuration settings to support the EMP.

If you have more than one EMP, you must set up the EMP LUNs as described in the next section.

You can configure the EMP LUN settings (see page 139) and polling intervals (see page 140).

9.2.1 Setting the EMP LUN

If you have only one EMP, the configuration settings are automatically enabled when the EF2800 is installed.

If you have more than one EMP, you must set up the EMP LUNs as described in this section.

The EF2800 allows in-band access to the EMP in the disk enclosure under the EF2800's target ID using direct EMP commands. You can set an EMP LUN to any value between 0 and 63, except where it would conflict with a previously assigned LUN (EMP, partition, or management). You can also set it to NONE, which tells the EF2800 not to present a LUN for this EMP under the EF2800's target ID.

You can set LUNs for EMPs that you plan to add by assigning a LUN to the EMP ID you want to use. The EF2800 assigns EMP IDs sequentially each time it starts.

NOTE: EMP LUN settings have no effect on the CAPI interface, which always allows communication with all of the EMPs connected to the EF2800.

You may want to change the EMP LUN if it conflicts with the LUN of another device.

To change the EMP LUN:

1. From SAM, select **Manage EF2800** > **General Config** > **Enclosure Management**.

   The Enclosure Management page displays. The Set EF2800 EMP LUNs panels display the current LUN for each EMP. Each EMP has an EMP number that the EF2800 assigns sequentially whenever it starts.

2. Select the LUN you want for each EMP.

3. Click **Update EMP Configuration**.

9.2.2 Changing the Additional EMP Setting

You can change four additional EMP settings:

- EMP Polling Rate: This is the interval, in seconds, that the EF2800 polls the EMPs for status changes. If the polling rate is set to zero, the EF2800 does not communicate with the EMP. Only use this setting if you suspect you are having communication problems with the EMP. The default setting is five seconds.

To change the EMP setting:

1. From SAM, select **Manage EF2800** > **General Config** > **Enclosure Management**. The Enclosure Management page displays.

2. In the Enclosure Management Processor General Settings panel, select **EMP Polling Rate**.

3. Click **Update EMP Configuration**.

10

Troubleshooting and Problem Solving

10.1 Overview

The EF2800 enclosure includes a processor and associated monitoring and control logic to enable it to diagnose problems within the enclosure's power, cooling and drive systems.

The Enclosure Services Processor is housed along with the Ops Panel in the rear of the enclosure.

The sensors for power and cooling conditions are housed within the power supply/cooling modules. There is independent monitoring for each unit.

If a fault is indicated on the Ops Panel, please refer firstly to Figure 62 and then to the section referenced within that table.

10.1.1 Initial Start-up Problems

10.1.1.1 Faulty Cords

First check that you have wired up the enclosures correctly. Then, if:

- cords are missing or damaged
- plugs are incorrect
- cords are too short

Call Customer Service for a replacement.

10.1.1.2 Alarm Sounds On Power Up

Please refer to Section 10.3.

10.1.1.3 Green "Signal Good" LED on I/O Module is Off

Check that the Rx and Tx cables have not been inverted during installation.

10.1.1.4 Computer Doesn't Recognize the EF2800 System

1. Check that the FC-AL interface cables from the EF2800 enclosure to the host computer are fitted correctly.
2. Check the Drive Select ID settings on your EF2800 enclosure and on your system host.
3. Check that the LEDs on all installed drive carrier modules are illuminated green. Note that the drive LEDs will not be lit during drive spinup.
4. Check that all drive carrier modules have been correctly installed.
5. Check that there is a valid FC-AL signal present at the I/O connector. If there is no signal present check that the cable has not been inverted during installation.
6. Check the I/O module setup as follows:
   - Check that the I/O module has been correctly installed and all external links and cables are securely fitted.
   - Check the maximum cable length has not been exceeded.

10.2 LEDs

Green LEDs are always used for good or positive indication, flashing Green/Amber if non-critical conditions exist. Amber LEDs indicate there is a critical fault present within the module.

10.2.1 Ops Panel

The Ops Panel displays the aggregated status of all the modules. The Ops Panel LEDs are shown in Figure 61 and defined in Figure 62.

For details on how to remove and replace a module see Section 10.7.

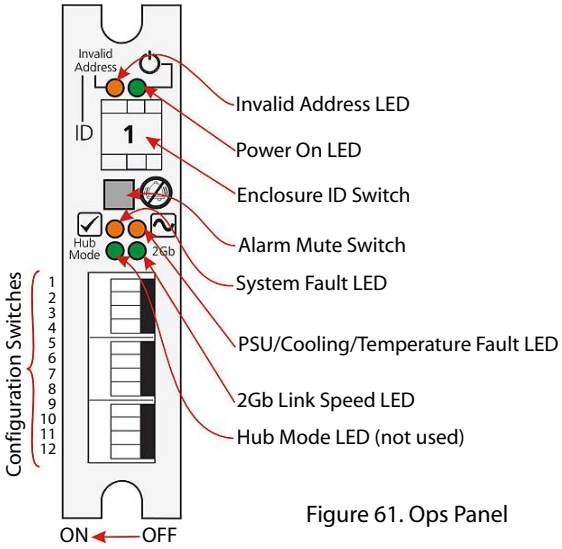

Figure 61. Ops Panel

Figure 62. Ops Panel LED States

Ops Panel LEDs					Other Associated LEDs or Alarm	State Description
Power (Green)	PSU/ Cooling/ Temp (Amber)	System (Amber)	Address Mode Error (Amber)	Loop Speed		
On	Off	Off	Off			Power On, all functions good
On	Off	Off	Off	Off		5V Aux present, overall power failed

Figure 62. Ops Panel LED States

Ops Panel LEDs					Other Associated LEDs or Alarm	State Description
Power (Green)	PSU/ Cooling/ Temp (Amber)	System (Amber)	Address Mode Error (Amber)	Loop Speed		
On	On	On	On	On	single beep, then double beep	Ops Panel power On (5s) test state
On	On	Off			PSU LEDs or Fan LEDs	Any PSU fault or Fan fault
On	On	Flash-ing				Over or Under temperature
On	Off	On			ESI LED on I/O module A	ESI processor #A Failed
On	Off	On			ESI LED on I/O module B	ESI processor #B Failed
On	Off	On			None	- Unknown (invalid or mixed) LRC module type installed, or - 1^2C Bus Failure (inter ESI processor), or - Backplane autostart watchdog failed.
On	Flash-ing	Flash-ing			PSU Removed	PSU removed and System power redundancy check option set. No indication if option not set.
On	Off	Flash-ing				No SES Drives installed
On	Flash-ing	On			Intermittent audible alarm	Ops to ESI Communications failed
On			Flash-ing			Invalid address mode setting (change thumb wheel to valid ranges)
On				On		2Gb Drive loop speed selected
On						RAID ONLY Host side Hub mode enabled

10.2.2 Controller I/O Module

The EF2800 I/O module incorporates the following LED indicators, shown in Figure 63:

- Host Port 0 Signal Good (Green)
- Host Port 1 Signal Good (Green)
- Expansion Port 1 Rx Good (Green)
- Expansion Port 2 Rx Good (Green)
- ESI/LRC module fault LED (Amber)
- Cache Active (Green)
- RAID Controller Activity
  - Ready (Green)
  - Host Activity of either host channels (Flash off)
- Battery Fault (Amber)

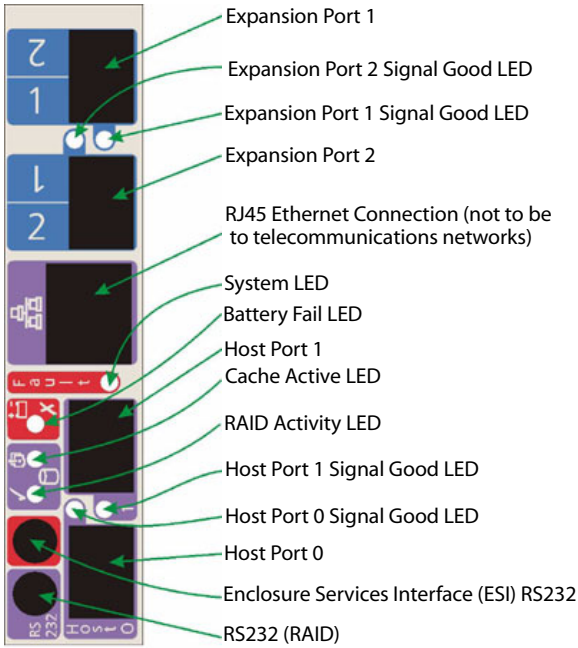
Expansion Port 1
Expansion Port 2 Signal Good LED
Expansion Port 1 Signal Good LED
Expansion Port 2
RJ45 Ethernet Connection (not to be to telecommunications networks)
System LED
Battery Fail LED
Host Port 1
Cache Active LED
RAID Activity LED
Host Port 1 Signal Good LED
Host Port 0 Signal Good LED
Host Port 0
Enclosure Services Interface (ESI) RS232
RS232 (RAID)

Figure 63. I/O Module LEDs

Figure 64 describes the LED status lights located on the front of the SM module. For information about determining the cause of an amber or red LED, see Appendix E, "Monitoring System Status" on page 259.

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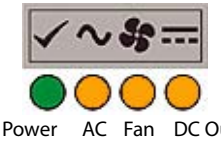
Figure 64. Storage Manager Module LED Status Descriptions

LED	Description	Color	Function
.STATUS	SM Status	Green	Solid when EF2800 is on and this SM is online.
		Amber	Flashing when initializing. Solid if LAN Subsystem or battery has a fault.
		Red	Solid when EF2800 is on and this SM is offline. Some causes are: • Module has a hardware failure • User put or forced offline or shut down SM • Latch is not fully closed • Revision level of module is incompatible with the other SM
BAT-TERY.	Battery	Green	Solid when SM is on and battery is working properly.
		Amber	Flashing when EF2800 is powered off and data in the battery-backed cache is valid. If the SM is not gracefully shutdown, also flashes amber, whether there is data in the write-back cache or not. Solid when SM is on and write-back cache is disabled.
		Red	Solid when SM is on and battery is not working properly.
Ether-net ACT	Ethernet activity	Green	Flashing or solid when 10/100BaseT link is active or busy.
Ether-net LINK	Ethernet link status	Green	Solid when Ethernet link is detected.
		Off	When Ethernet link is not detected.
		Amber or Red	Solid when LAN Subsystem of SM has a fault.

10.2.3 Power Supply/Cooling Module

The Power Supply Cooling LEDs are shown in Figure 65. Under Normal conditions the LEDs should all be illuminated constant green. If a problem is detected the color of the relevant LED will change to amber.



PSU Good: Green
AC Input Fail: Amber
Fan Fault: Amber
DC Output Fail: Amber

Figure 65. PSU LEDs

10.3 Audible Alarm

The Ops Panel also includes an audible alarm which indicates when a fault state is present. The following conditions will activate the audible alarm:

- Drive Fault
- Fan Fault
- Voltage out of range
- Over temperature
- Thermal overrun
- System fault

10.3.1 Audible Alarm Mute

When the audible alarm sounds, it may be muted by pressing the Alarm Mute push-button. Automatic muting will take place after two minutes if the mute switch is not manually operated. The Alarm Mute push-button is located above the indicators on the Ops Panel (Figure 61).

When the alarm is muted it will continue to sound with short intermittent beeps to indicate that a problem still exists. It will be silenced when all problems are cleared.

10.3.2 LED Test Mode

The Alarm Mute push-button can also be used to test the LEDs on the Ops Panel. When the Mute push-button is held, all LEDs will be illuminated if there are no faults present.

10.4 Troubleshooting

The following sections describe common problems, with possible solutions, which can occur with your EF2800 system

10.4.1 System Faults

Symptom	Cause	Action
1. The SYSTEM LED turns amber on the Ops panel. **2.** Audible alarm is activated.	The ESI processor has detected an internal fault (e.g. failure of an internal communications path)	**1.** Check for other amber LED indications on the power supply/cooling modules. If there is a PSU error present there may be a communications problem with that power supply/ cooling module. Remove and then re-fit the module, if the problem persists then replace the module. **2.** Check for other amber LED indications on the drive modules. If none are evident then there may either be an ESI processor problem or a backplane problem. **3.** Ops panel module failed. Please contact Customer Service for replacement. (see Section 10.7.2)

10.4.2 Power Supply/Cooling Faults

Symptom	Cause	Action
1. Ops panel FAULT LED turns amber. **2.** An amber LED on one or more power supply/ cooling modules. **3.** Audible alarm is activated.	**1.** Any power fault. **2.** A fan failure. **3.** A thermal condition which could cause PSU overheating.	**1.** Check Power On/Off Switch on rear of power supply/cooling module is turned ON. (not accessible on later models) **2.** Check AC Mains connections to power supply/cooling module is live. **3.** Disconnect the power supply/cooling module from AC power and remove the module from the system. Re-install: if problem persists, replace power supply/ cooling module. **4.** Reduce the ambient temperature.

10.4.3 Thermal Control

The EF2800 Enclosure uses extensive thermal monitoring and takes a number of actions to ensure component temperatures are kept low and also to minimize acoustic noise. Air flow is from front to rear of the enclosure.

Symptom	Cause	Action
If the ambient air is cool (below 25 °C) and the fans are observed to increase in speed then some restriction on airflow may be causing additional internal temperature rise. **Note:** This is not a fault condition.	The first stage in the thermal control process is for the fans to automatically increase in speed when a thermal threshold is reached. This may be caused by higher ambient temperatures in the local environment and may be perfectly normal. **Note:** This threshold changes according to the number of drives and power supplies fitted.	**1.** Check the installation for any airflow restrictions at the front and rear of the enclosure. A minimum gap of 1" (25mm) at the front and 2" (50mm) at the rear is recommended. **2.** Check for restrictions due to dust build-up, clean as appropriate. **3.** Check for excessive re-circulation of heated air from rear to the front. Use in a fully enclosed rack installation is not recommended. **4.** Check that all blank/ dummy modules are in place. **5.** Reduce the ambient temperature.

10.4.4 Thermal Alarm

Symptom	Cause	Action
1. Ops panel FAULT LED turns amber. **2.** An amber LED on one or more power supply/cooling modules. **3.** Audible alarm is activated. **4.** Air temperature exiting PSU above 55°C.	If the internal temperature measured in the airflow through the enclosure exceeds a pre-set threshold a thermal alarm is activated.	**1.** Check local ambient environment temperature is below the upper 40°C specification. **2.** Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 1" (25mm) at the front and 2" (50mm) at the rear is recommended. **3.** Check for restrictions due to dust build-up; clean as appropriate. **4.** Check for excessive re-circulation of heated air from rear to the front. Use in a fully enclosed rack installation is not recommended. **5.** If possible shutdown the enclosure and investigate the problem before continuing.

10.5 Drive Carrier Module Faults

Disk drive status is monitored by a green LED and an amber LED mounted on the front of each Drive Carrier Module, providing the following indications:

State	Green	Amber
No drive fitted	Off	Off
Drive Power ON	On	Off
Drive Activity	Flashes	Off
Drive Fault	On	On

Drive activity - LED may be off for a length of time during power up.

10.5.1 Dummy Carrier Modules

Dummy Carrier modules must be fitted to all unused drive bays to maintain balanced air flow.

10.5.2 Auto Start Failure

Unless otherwise selected at installation time, all drives in the enclosure should automatically start their motors after power is applied. If this has not occurred there is a power problem (An alarm and power fault indication would normally be active).

NOTE: The SYSTEM LED will flash green/amber.

10.6 Dealing with Hardware Faults

Ensure that you have obtained a replacement module of the same type *before* removing any faulty module.

If the enclosure is powered up and you remove any module, replace it immediately. If the enclosure is used with modules or module blanks missing for more than a few minutes, it can overheat, causing power failure and data loss. Such use will invalidate the warranty.

- Replace a faulty drive with a drive of the same type and equal or capacity.
- All drive bays must be fitted with a Drive Carrier module or a dummy carrier module in order to maintain a balanced air flow.
- All the supplied plug-in power supply units, electronics modules and blank modules must be in place for the air to flow correctly around the cabinet.

10.6.1 Continuous Operation During Replacement

Depending on how the enclosure is set up, if a disk unit fails, it can normally be replaced without interrupting the use of the system.

In addition, each enclosure contains two power supply/cooling modules, either of which can maintain power and cooling to the Subsystem while the other is replaced.

10.7 Replacing a Module

Please refer to Chapter 2, "Getting Started" on page 15 for information on the initial installation of the plug-in modules in the EF2800 enclosure.

Observe all conventional ESD precautions when handling the modules and components. Avoid contact with Backplane components and module connectors.

10.7.1 Power Supply/Cooling Modules

Do not remove covers from the power supply unit. Danger of electric shock inside. Return the PSU to your supplier for repair.

10.7.1.1 Removing the Module

If a power supply unit or its fan has failed, you must replace the whole power supply/cooling module. As there should always be two power supply units installed, you can continue working while replacing the faulty module.

Do not remove the faulty module unless you have a replacement unit of the correct type ready for insertion.

1. Make sure you identify the faulty power supply/cooling module correctly, from the two modules installed,
2. Switch off and disconnect the power supply cord.
3. Squeeze the two latches on the PSU handle together (Figure 66).
4. Pull and swing open the handle to cam the module out of the bay.
5. Grip the handle and pull out the module.

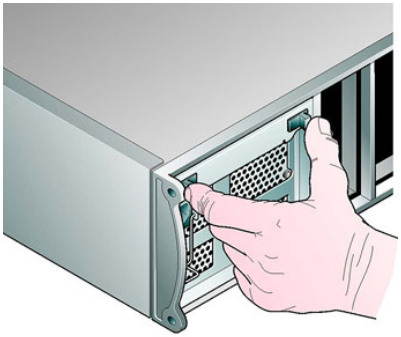


Figure 66. Disengage the Latches on PSU Module

10.7.1.2 Inserting the New Module

1. Check for damage, especially to the rear connector on the new module. Make sure the power switch is turned off.

CAUTION: Handle the module carefully and avoid damaging the connector pins. Do not install the module if any pins appear to be bent.

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2. Disengage the latches and swing open the handle (Figure 66).

3. Slide the module into the bay (Figure 67). Note the orientation of the module in right hand bay (Bay 1) which should be "upside down".

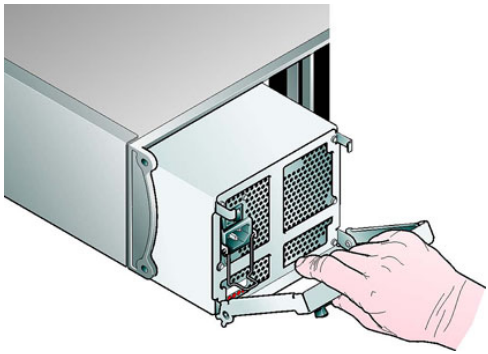

Figure 67. PSU Modules in Rear Panel

4. Cam the module home by manually closing the handle. A click should be heard as the latches engage.

5. Connect the power cord and turn on the power switch.

NOTE: The alarm will sound until the new power supply/cooling module is operating correctly.

10.7.2 Ops Panel

The Ops Panel is an integral part of the enclosure chassis assembly and is not field replaceable.

10.7.3 Storage Manager Module

Please refer to Section 2.4 for full information on installing the Storage Manager module.

NOTE: Fitting of a RAID controller to the I/O module is a factory only operation.

As there should always be two SM modules installed, you can continue working while replacing the faulty module.

10.7.3.1 Removing the Module

Do not remove this module unless a replacement module is available. The system must not be run without all modules in place.

1. Ensure that you correctly identify the faulty module from the two modules installed.
2. Make note of how the cables are connected to the I/O module. Then disconnect the cables.
3. Using both hands, squeeze open the two latches (Figure 68).

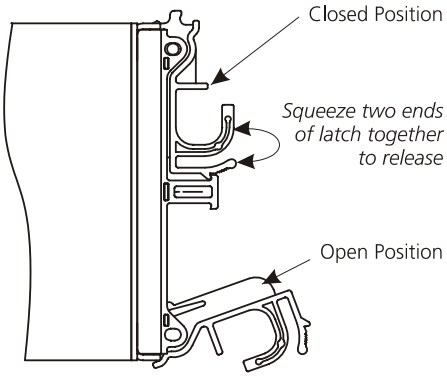

Figure 68. LRC I/O Module Latch Operation

4. Pull and swing open the latches to cam the module out of the bay.

5. Grip the latch handles and the module out of the bay (Figure 69).

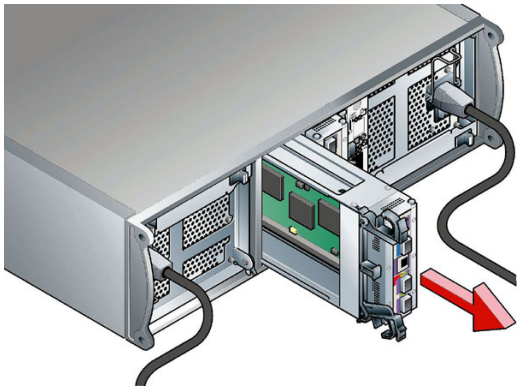

Figure 69. Removing an LRC I/O Module

10.7.3.2 Inserting the Module

1. With the latches in the open position, slide the module into the bay until the latches engage automatically.

2. Cam the module home by manually closing the latches. A click should be heard as the latches fully engage.

3. Reconnect the cables to the module.

10.7.3.3 Insertion/Removal of SFP Modules

The I/O module is fitted with four Small Form Factor (SFP) GBIC modules. Replacement of these modules should be performed in accordance with the following procedure:

1. Press down firmly on the removal tab located at the bottom of the cable.

2. Remove the module by firmly gripping each side of it.

CAUTION: If the module cannot be easily removed do not use force. Repeat step 1.

10.7.4 Drive Carrier Module

Please see Section 2.7, "Drive Carrier Installation" on page 27 for information on the initial installation of the plug-in modules in the EF2800 enclosure.

Observe all conventional ESD precautions when handling EF2800 modules and components. Avoid contact with backplane components and module connectors.

10.7.4.1 Removal and Replacement

CAUTION: Drive spin down
Damage can occur to a drive if it is removed while still spinning. If possible use the operating system to spindown the drives prior to removal. If this is not possible we recommend that you perform **All** steps of the following procedure to ensure that the drive has stopped prior to removal:

1. Disengage the anti-tamper lock.
2. Release the module handle by pressing the latch in the handle.
3. Gently withdraw the drive module approximately 1" (25mm) and wait 30 seconds. This will allow the drive to spin down prior to full removal.
4. Withdraw the module from the drive bay and install a replacement module in accordance with the instructions in Section 2.7 page 27.

10.8 Problems Accessing the EF2800 via Ethernet Port

Problem: You cannot access the EF2800 using the default IP address of 10.0.0.1.

Your distributor or another user may have changed the default IP address. Use the RS-232 connection to access the EF2800 and configure the IP address.

Problem: SAM pages do not display properly.

- Be sure that your system meets the system requirements described in Section 3.1, "SAM System Requirements" on page 44.
- Configure your browser according to the information given in Section 3.1, "SAM System Requirements" on page 44.
- Click **Refresh** or **Reload** in your browser to display the most current SAM information.
- Be sure that no other user is accessing the EF2800 using the menu-based interface or the Configuration Application Programming Interface (CAPI). It is possible for other user to change the EF2800's configuration using these other interfaces. The other user's changes may not display in SAM until you refresh the SAM page.
- If you are using Windows NT and Internet Explorer, make sure that the Ignore Colors option is not selected from **Tools** > **Internet Options** > **Accessibility**.

Problem: SAM Help Page is not displaying.

If you display Help Page for one page in SAM, do not close the Help Page window, and display Help Page for another SAM window, the Help Page window stays minimized. Either click the minimized window in the Windows task bar to display the latest Help or close the Help Page window each time you finish using it.

10.9 Host Fibre Channel Problems

Problem: The host system does not see the EF2800.

Verify in the **Monitor EF2800 > Status > FC Port Status** page (or in the Disk Array Administrator, the <Ctrl>-<E> CFG Info screen) that the host channel FC World Wide Name is valid. Verify that the port ID is active and a valid arbitrated loop port address (AL_PA) is assigned. Verify the array LUN numbers are configured correctly and not overlapping.

Problem: The FC host port and switch or HBA do not establish a link.

When changing from Loop to Point to Point mode after already establishing a public loop connection, the switch may ignore subsequent attempts to perform point-to-point initialization. Take one of the following actions to establish the point to point connection:

- Physically disconnect and reconnect the FC cable.
- Configure the switch port to force point-to-point mode.
- Change the link speed for that port on the EF2800 and then change it back. The switch recognizes the change from loop to point to point due to the disruption caused when going to the other link speed (useful if EF2800 is being remotely managed). For information about setting up the host ports, refer to Section 4.1.1, "FC Host Port Link Speed" on page 57.
- Restart both SM modules. For information about restarting the SM modules, refer to Section 4.3, "Restarting the SMs" on page 61.

10.10 Array Problems

Problem: Array is much smaller than it should be.

The backoff percent may be set higher than 1%, which is causing the array to be much smaller than the full size of its member disks.

NOTE: We strongly recommend that you leave the backoff percent at 1%.

Setting the backoff percent "backs off" or reduces the capacity of the array by the given percentage. The backoff percentage helps when you assign spares by compensating for the minor capacity differences that occur between vendors. For example, two 18-GB drives from two different vendors may differ in capacity by 100 MB. With a backoff of 0%, you would not be able to replace an array member's slightly larger 18-GB drive with a smaller 18-GB drive. If you intend to only use identical drives from the same vendor, you can use a backoff of 0%.

The default setting is 1% backoff. This default allows you to easily work with drives that have the same nominal capacity, but different actual capacities. The backoff percentage affects all arrays created on the EF2800 after you set the percentage.

If the drives in an array are not equal in size, the array capacity in a RAID 5 array is based on the smallest member's capacity. The backoff percentage is then taken off the capacity from that amount.

To change the backoff percentage via SAM:

1. From SAM, select **Manage EF2800** > **General Config** > **Option Configuration**. The Option Configuration page displays.

2. Enter the Backoff Percent you want. Enter the percentage as three digits using the following format: 00.0%. The default setting is 01.0%.

To change the backoff percentage using Disk Array Administrator: A change to this setting on either SM module is automatically updated on the other SM module.

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Backoff Percent** and press <Enter>. The Backoff Percent screen displays.

3. Enter the Backoff Percent you want to use and press <Enter>. Enter the percentage as three digits using the following format: 00.0%. The default setting is 01.0%.

10.11 EF2800 Problems

Problem: The Storage Manager module's Status LED does not turn on.

Check that the SM module is properly seated in the slot and the handles are closed and locked. Check for events in SAM and the RS-232 interface (Disk Array Administrator) for power-on initialization and diagnostics errors.

Problem: The EF2800 reports an SDRAM memory error.

Contact Technical Support.

10.12 Problems During Startup (when using Disk Array Administrator)

The following sections describe problems you might encounter when using the Disk Array Administrator during Power On Self-Test (POST) or during startup and explain how to resolve those problems. POST shows problems related to the processor, logic, and memory.

Problem: EF2800 failed the onboard memory test.

When this failure occurs, it means the internal CPU memory failed. Contact Technical Support for a replacement.

Problem: System hangs at Loading Bridge during BFLU Loader Menu.

Update the software to ensure you are using the latest version. See section 8.13, "Updating Software" on page 131. If you cannot update the software or if the updated software does not correct the problem, replace the SM.

Problem: One of the POST diagnostic tests failed.

Contact Technical Support.

Problem: The system hangs at CT_srv starting.

- Check the disk and host ports to make sure they are properly connected.
- Check the enclosure to make sure everything is properly connected.

10.13 Terminal Emulator and COM Port Problems

Problem: Screen continuously puts out garbage characters.

The likely cause of this problem is a baud rate mismatch between the terminal emulator and the EF2800. The default baud rate is 115,200. Follow these steps if you set your terminal emulator to this rate and still get garbage characters:

1. If you are able, shut down both SMs.

   For information about restarting the SMs, refer to Section 4.3, "Restarting the SMs" on page 61. If you are unable to shut down the EF2800, go to the next step.

2. Turn off the power on both power supply/cooling modules.

3. Press and hold down the spacebar of your terminal emulator.

4. Turn on the power while continuing to hold down the spacebar. This will allow the EF2800 to auto-detect the baud rate setting.

5. When the Flash Utility appears, select **Option 5** to continue to start the SM.

NOTE: Some terminal emulators do not immediately change to the new baud rate settings, and you have to exit and restart the emulator to use the new settings.

Problem: Nothing is displayed on the terminal emulator screen.

The probable cause of this problem is a bad RS-232 cable connection or swapped transmit/receive lines. If the cable is properly connected on both ends, try a *null modem* adapter that will reverse the RS-232 transmit and receive signals. The need for a null modem adapter depends on the RS-232 cable you are using.

Problem: The EF2800's STATUS LED is on, but there is no RS-232 display.

Check that the RS-232 cable is the correct type (straight-through). Check that the terminal emulation utility on the computer system is properly configured. See section C.2, "Via the Ethernet Port" on page 197.

Problem: Screen is updated, but will not respond to keystrokes.

Be sure you are using a straight-through serial cable or try using a null modem adapter. Disable hardware flow control on the terminal or terminal emulator. The EF2800 supports Xon/Xoff flow control and works properly in most cases with no flow control.

Problem: Screen looks correct, but clock is not being updated.

Check to be sure that the EF2800 is still powered on. If you are using Xon/Xoff, press the <CTRL> key and <**Q>** key simultaneously to start data flowing.

Problem: Screen is updated and menus appear correctly, but boxes around menus look incorrect.

Try a different font in your terminal emulator program, such as Terminal. If you cannot find a font that looks correct, set ASCII Display to **Yes** in the Display options item of the Configuration Menu.

10.14 Warning and Error Events

There are a number of conditions that trigger warning or error events, activate the alarm, and may affect the state of the Status and Fault LEDs. The alarm or buzzer sounds mainly when SAM or the Disk Array Administrator displays a warning or error event.

The alarm will silence when you press the Mute button on the EF2800, mute the alarm in SAM (refer to Section 8.5, "Changing the Alarm Mute Setting" on page 122) or acknowledge the event by pressing <**Esc>** in the Disk Array Administrator. The events in these categories are listed below.

10.14.1 Warnings

Warning events let you know that something related to the EF2800 or an array has a problem. You should correct the problem as soon as possible. Figure 70 defines each warning event and recommends the action you should take.

Figure 70. Warning Events

Event	Definition	Recommended Action
ARRAY CRITICAL	One or more drives are down and the array is online, but is no longer fault tolerant.	Add a spare to the array or the spare pool. Then replace the bad drives. Refer to Section 5.4..
ARRAY OFFLINE	More than one drive in a RAID 0 or volume set went down bringing the array to an offline state. This array is no longer accessible by the host.	Replace the bad drive and restore the data from backup.
BATT FAIL INFO	A warning condition in the battery pack or charging interface has been detected.	Contact Customer Service for battery replacement.

Figure 70. Warning Events (Continued)

Event	Definition	Recommended Action
BOOT ONLINE FAIL	During startup, the system attempted to put the specified module online. This operation failed.	The event gives a reason why the Put Online failed. Examine this reason and take the appropriate action. If the reason is DIAGNOSTIC FAIL, a hardware problem was found with the module. In this case, try replacing the module with a different one.
DISK CHAN DEGRAD	Errors detected on one of the disk channels have caused the EF2800 to mark the channel as degraded.	Determine the source of the errors on the specified disk channel and replace the faulty hardware.
DRIVE DOWN	An error occurred with the drive and it was downed, removing it from the active array.	Add a spare to the array or the spare pool. Then replace the bad drive. Refer to Section 5.4..
HW STATUS CHANGE	A SM has detected a significant change in the status of one of the power modules.	If the event indicates that the module has failed or is not present, install a new module.
OTHER WWN UNKNOWN	The host Fibre Channel World Wide Names (node and port) previously presented by the other SM module (which is currently offline) in this system are unknown. This event has two possible causes: The online SM module reporting the event was replaced or moved while the system was powered off. The online SM module had its flash configuration cleared (this is where the previously used WWNs are stored).	The online Storage Manager module recovers from this situation by fabricating a WWN for the other SM module based on its own serial number. If you see this event, then you need to verify the WWN information for the other SM module on all hosts that access it.

Figure 70. Warning Events (Continued)

Event	Definition	Recommended Action
PREV WWN UNKNOWN	The host Fibre Channel World Wide Names (node and port) previously presented by this Storage Manager module in this system are unknown. This event has two possible causes: One or both SM modules in a have been replaced or moved while the system was powered off. One or both SM modules have had their flash configuration cleared (this is where the previously used WWNs are stored).	This SM module recovers from this situation by using WWNs based on its own serial number. If you see this event, then you need to verify the WWN information for this SM module on all hosts that access it.
REPLACE BATTERY	The battery is approaching its four-year life span.	Contact Customer Service for battery replacement.
SDRAM CORR ECC	A correctable single-bit cache memory ECC error occurred.	Contact your Supplier.
SPARE UNUSABLE	The drive still contains metadata that must be cleared.	Clear the metadata from the spare drive. See Section G.1.2 on page 288.
SMART EVENT	A disk drive informational exceptions page control (IEPC) predictive failure message was received. No actions by the EF2800 are taken on the drive for these events.	Run diagnostics available from your operating system on the affected drive. Replace the drive, if necessary.
SYS OFFLINE FAIL	The system attempted to use Put Offline on an SM, but the request was rejected, probably because availability to the hosts would have been affected.	This Put Offline request may occur when you press one of the module latches to remove the module. In this case, we recommend that you do not take the module offline.

Figure 70. Warning Events (Continued)

Event	Definition	Recommended Action
SYS ONLINE FAIL	The system attempted to Put Online a newly inserted module, however the Put Online request failed.	The event gives a reason why the Put Online failed. Examine this reason and take the appropriate action. If the reason is DIAGNOSTIC FAIL, a hardware problem was found with the module. In this case, try replacing the module with a different one.
UNWRITABLE CACHE	The SDRAM cache has battery backed-up data, and the arrays assigned to this data are not present.	Either determine which drives are missing and reinstall them, or select **Yes** when asked if you want to discard this data.
VOLT/ TEMP WARN	The analog-to-digital convertor monitored a temperature or voltage in the warning range.	Check that the fans are running. Check that the ambient temperature is not too warm. Check for any obstructions to the air flow.

10.14.2 Errors

Error events let you know that something related to the EF2800, module, or disk drives has failed and requires immediate attention. Figure 71 defines each error event and recommends the action you should take.

Figure 71. Error events

Event	Definition	Recommended Action
ARRAY CRITICAL	One drive in the specified array failed and the array is running in degraded mode (not fault tolerant).	Replace the failed drive and add it as a spare to the critical array. If you have dynamic spares enabled, you only need to replace the drive. The system will automatically reconstruct the array.
BATTERY FAILED	A failure in the battery pack or charging interface has been detected.	Check that the battery is firmly connected to the SM module. Contact Customer Service for battery replacement.
DISK CHAN FAILED	An error has occurred in communicating on the disk channel.	Check the cables on the channel.
SDRAM UNCORR ECC	A non correctable multiple-bit cache memory ECC error occurred.	Contact Technical Support.
VOLT/ TEMP FAIL	The analog-to-digital convertor monitored a temperature or voltage in the failure range.	Check that the EF2800's fans are running. Check that the ambient temperature is not greater than 40°C. If the Power Supply/Cooling modules have no errors, replace the SM module where the error occurred.

10.15 Setting Up and Viewing the Debug Log

You can set up additional logging when instructed by DataDirect Network's technical support personnel.

Summary of Debug Log Capabilities

- Single controller debug information: available from the Disk Array Administrator via the serial port on each controller module. Because of the direct connection of the serial port to a storage controller, debug information from this port can sometimes provide information unavailable from the Ethernet port, but this information will only be from one storage controller of the redundant storage controller pair. This information is available as long as one individual controller can boot, read its flash memory and communicate with it's serial port.
- Combined log debug information: available through the SAM via the Ethernet port on each controller module.

  This set of logs will have several advantages over the single controller logs, but will also have a limitation in that collecting all the log data and passing it out via the Ethernet port requires a greater amount of hardware/software to be operational than for the single controller serial port case. Therefore, in some product failure scenarios the combined logs will potentiality have some holes in the debug data and it will also be necessary to review the single controller logs.

10.15.1 Collecting Debug Logs

For most problem scenarios you should collect ***three*** logs, a combined log from one of the two SAM Ethernet port connections and a single controller log from each of the two Disk Array Administrator local serial port connections.

NOTE: If one of the redundant controllers is down we recommend that you restart that Storage Manager module, if possible, before collecting the debug logs.

10.15.1.1 SAM: Manage/Utilities/Debug Utilities/Save Debug Logs/Save Log Files

1. You may optionally enter contact information, which will be included in the log information file. By doing so, your contact information and comments will help create a unique document that may be used to identify the issue and origin when these logs are being collected for diagnostic purposes.

2. Make checkbox selections for the logs you want to collect:
   - Device status summary - basic status and configuration information for the device.
   - Event logs - event logs from both controllers when in active-active mode.
   - Diagnostic debug logs - debug logs from both controllers when in active-active mode.
   - Boot logs - startup sequence for each storage controller.
   - Critical error logs - up to 4 critical error dumps from each controller. these will not exist if no critical errors have occurred.
   - CAPI trace - interface activity between the controller's internal processors.

3. Click on **Generate Debug Logs** - this operation can take up to several minutes, depending on the logs selected."

4. Click on **Download Selected Logs To File** - to use your browser's file save capabilities to save the log in the location you prefer.

5. Name the file - to include date. bug number or problem name and some indication that this is a combined log, e.g. 20030113_bug#123_Combined.logs.

10.15.1.2 Disk Array Administrator on Controller: Utilities Menu

1. Start a "data capture" session on your terminal emulator program (in Hyperterm this is the **Transfer/Capture Menu** drop-down menu selection.

2. Name the file - to include date. bug number or problem name and SM-A or -B, e.g. 20030113_bug#123_SM-A.txt.

3. Select **Dump Debug Info** from the utilities menu of Disk Array Administrator.

4. Allow the data dump to complete.

5. Stop the "data capture" session on your terminal emulator program.

6. Repeat the above steps for the second controller.

10.15.2 Configuring Debug Logs

For most log collection scenarios, you should utilize the factory-configured debug log setup on the RAID system. If you are advised by Technical Support to modify the debug log setup, follow these steps:

1. Follow the steps in section 10.15.1.1 above.

2. Select the Debug Configuration options as advised by technical personnel.

10.15.2.1 Using SAM to Set Up and View Debug Log

You can select additional events, which are not normally logged, for the debug log. Under normal conditions, you should not have any of the events selected. The additional events have a slight effect on read and write performance.

You can also save the debug log to a file. For more information, see section 7.4, "Saving Log Information to a File" on page 112.

To set up the debug log:

1. From SAM, **select Manage EF2800 > Utilities** > **Debug Log Configuration**. The Debug Log Configuration page displays. Select each additional event you want in the debug log.

2. Click **Change Debug Configuration**.

To view the debug log:

1. From SAM, select **Manage EF2800** > **Utilities** > **View Debug Log**. The View Debug Log page displays.

2. Select the viewing options you want.

3. Click **Load/Reload Debug Log**.

10.15.2.2 Using Disk Array Administrator to Set Up Debug Log

You can view a debug log by pressing <Ctrl>-<E>. Pressing <Ctrl>-<E> toggles you through the event log, debug log, hardware information, and configuration information screens.

To set up debug logging:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.

1. Select **Debug Log Enable** and press <Enter>. The Debug Log Enable screen displays.

2. Select each logging item that you want to turn on and press <Enter>.

3. Select **Save Changes** and press <Enter>.

10.16 Using the Loader Diagnostics Menu

If you have any diagnostic errors, contact Technical Support.

10.17 Using the Loader Utility Menu

If you have any diagnostic errors, contact Technical Support.

10.18 Understanding Disk-related Errors

The event log includes errors reported by EMPs and disk drives on your system. If you see these errors in the event log, the information below may assist you. For more information about viewing the event log, refer to Section 7.2, "Displaying the Event Log" on page 108.

10.18.1 Disk Errors

If a disk detects an error, it reports the error, which is recorded in the event log. Figure 72 lists some of the most common SCSI sense key descriptions (in hexadecimal). Figure 73 lists the descriptions for the most common sense codes (ASC) and sense code qualifiers (ASCQ), all in hexadecimal. Refer to the *SCSI Primary Commands - 2 (SPC-2) Specification* for a complete list of ASC and ASCQ descriptions.

Figure 72. Common sense key descriptions

Sense Key	Description
0h	No sense
1h	Recovered error
2h	Not ready
3h	Medium error
4h	Hardware error
5h	Illegal request
6h	Unit attention
7h	Data protect
8h	Blank check
9h	Vendor-specific
Ah	Copy aborted
Bh	Aborted command
Ch	Obsolete
Dh	Volume overflow
Eh	Miscompare
Fh	Reserved

Figure 73. ?Common ASC and ASCQ descriptions

ASC	ASCQ	Descriptions
0C	02	Write error—auto-reallocation failed
0C	03	Write error—recommend reassignment
11	00	Unrecovered read error
11	01	Read retries exhausted
11	02	Error too long to correct
11	03	Multiple read errors
11	04	Unrecovered read error—auto-reallocation failed
11	0B	Unrecovered read error—recommend reassignment
11	0C	Unrecovered read error—recommend rewrite the data
47	00/01	FC CRC error
48	00	Initiator-detected error message received

10.18.2 Disk Channel Errors

Disk channel errors are similar to disk-detected errors, except they are detected by the EF2800, instead of the disk drive. Some disk channel errors are displayed as text strings, others are displayed as hexadecimal codes.

Figure 74 lists the error code descriptions. Most disk channel errors are informational because the EF2800 issues retries to correct any problem. Errors that cannot be corrected with retries will result in another critical event describing the affected array (if any).

Figure 74. Disk channel error codes

Error Code	Description
Abort LkDn	I/O request was aborted because of third-party loop initialization procedure (LIP).
CRC Error	CRC error on data was received from a target.
Dev Busy	Target reported busy status.
Dn/Ov Run	Data overrun or underrun has been detected.
IOTimeout	EF2800 aborted an I/O request to this target because it timed out.
Link Down	Link down while communication in progress.
LIP	I/O request was aborted because of a channel reset.
No Respon	No response from target.
Port Fail	Disk channel hardware failure. This may be the result of bad cabling.
PrtcolError	EF2800 detected an unrecoverable protocol error on the part of the target.
QueueFull	Target reported queue full status.
Stat: 04	Data overrun or underrun occurred while getting sense data.
Stat: 05	Request for sense data failed.
Stat: 32	Target has been reserved by another initiator.
Stat: 42	I/O request was aborted because of EF2800's decision to reset the channel.
Stat: 44	EF2800 decided to abort I/O request for reasons other than bus or target reset.
Stat: 45	I/O request was aborted because of target reset requested by EF2800.
Stat: 46	Target did not respond properly to abort sequence.

10.18.3 Voltage and Temperature Errors and Warnings

Most voltage and temperature errors and warnings relate to the power supply/cooling modules. Check the following to resolve these errors or warnings:

1. Check that all of the fans are working by making sure all of the EF2800's LEDs are green or using the SAM status pages.
2. Make sure that all the EF2800 modules are properly seated in their slots and that their handles are locked.
3. Make sure that no slots are left open for more than two minutes.

   If you need to replace a module, leave the old module in place until you have the replacement ready or use a blank cover to close the slot. Leaving a slot open negatively affects the airflow and may cause the unit to overheat.
4. Try replacing each power supply/cooling module, one at a time.
5. Replace the SM modules, one at a time.

10.19 Slow Write Performance

This can be caused by powering down the enclosure without first shutting down the controllers.

NOTE: The battery must be greater than 90% charged for write-back cache to be enabled.

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A

Enclosure Specifications

A.1 Technical Specifications

A.1.1 Dimensions

Height:	5.3" (134mm)
Width across body of enclosure:	17.6" (446mm)
Depth:	20.2" (511mm)

A.1.2 Weight

Fully Loaded:	Rack mount: 81.0 lbs (37kg)
Empty Enclosure (Rack):	19.8 lbs (9 kg)
PSU/Cooling Module:	8.8 lbs (4 kg)
LRC I/O Module:	3.11lbs (1.5kg)

A.1.3 AC Power (450W PSU)

Voltage, auto-ranging:	100 - 120 / 200 - 240 VAC Rated
Frequency:	50-60 Hz
Inrush Current:	50A @ 260VAC
Power Factor:	>0.98
Harmonics:	Meets EN61000-3-2

A.1.4 PSU Safety and EMC Compliance

Safety Compliance:	UL 60950, IEC 60950, EN 60950
EMC Compliance:	CFR47 Part 15B Class A, EN55022, EN55024

A.1.5 Power Cords

(minimum requirements)

Cord Type:	SV or SVT, 18 AWG minimum, 3 conductor
Plug:	250V, 10A
Socket:	IEC 320 C-14, 250V, 15A

A.1.6 Environment

Ambient Temperature & Humidity:

	Temperature Range	Relative Humidity	Maximum Wet Bulb
Operational	5°C to 40°C	20% to 80% non-condensing	23°C
Non-Operational	0 °C to 50°C	8% to 80% non-condensing	27°C
Storage	1 °C to 60°C	8% to 80% non-condensing	29°C
Shipping	-40 °C to 60°C	5% to 100% non-precipitating	29°C

Altitude, Operational:	0 to 10,000 feet (0 to 3,047 m)
Altitude, Non-Operational:	-1,000 to 40,000 feet (-305 to 12,192m)
Shock, Operational:	Vertical axis 5g peak 1/2 sine, 10ms
Shock, Non-Operational:	30g 10ms 1/2 sine
Vibration, Operational:	0.21grms 5-500 Hz Random
Vibration, Non-Operational:	1.04grms 2-200 Hz Random
Vibration, Relocation:	0.3g 2-200 Hz sine
Acoustics:	Less than 6.0 B LwA - operating at 20°C
Orientation & Mounting:	19" Rack mount (3EIA Units) Rails: To fit 31.5" (800mm) depth racks compliant with IEC 297 Rack: Back pressure not exceeding 5 pascals (0.5mm water gauge)
Safety & Approvals:	CE, UL, cUL
EMC Compliance:	EN55022 (CISPR - A), FCC A

A.1.7 Interfaces

- 1 FC quad loop of 8 drives
- Passive backplane with 2 Loop Resiliency Circuit (LRC) I/O Modules
- SFP HSSDC - 2 cables, max. external cable length: 10m
- SFP optical cables, max. daisy-chain cable length: see manufacturer's specification
- Expansion: SFP, cable length as given above

A.1.8 Controller I/O Module Specification

Module:	• Speed: 2Gb • Creates connections to 2 × 8 drive mode dual loop structures • 2 External expansion ports, SFP connectors • 2 Host SFP ports • 1 Ethernet port
Mounting:	Rear Single Bays 3 and/or 4
Connectors:	• 2 × SFP module LC optical, max. cable length 500m; or 2 × Copper HSSDC-2 connector, max. cable length 6m • 1 × RJ45 Ethernet port • 1 × RS232, 6 pin Mini-DIN (factory-use only)
Power Dissipation:	5A @ 3.3V, 7.4A @ 5V
Battery Backup	• Li-ion battery, hold up time for RAID cache 512Mb for 72 hours (worst case)
LED Functions:	• Host Port 0 Signal good (green) • Host Port 1 Signal good (green) • Expansion Port 0 Rx good (green) • Expansion Port 1 Rx good (green) • ESI/LRC module fault LED (amber) • Cache active (green) • RAID controller ready (green) • Battery fault (amber)

A.1.9 Drive Carrier Module Specification

NOTE: Operating the enclosure with non-approved drives may invalidate the warranty.

Module Dimensions:	Height 1.15" (29.10mm) Width 4.19" (106.55mm) Depth 8.15" (207.0mm)
Weight:	1.94 lbs (0.88kg) for 1.0" 36GB drive
Operating Temperature:	5°C to 40°C (when installed in an enclosure with dual Power Supply/Cooling modules)
Power Dissipation:	18.7Watts maximum

A.1.10 RAID Card

RAID:	Intergrated Fibre-Fibre controller 600k Hrs MTBF
LRC & ESI Function:	1.2MHz
Memory:	512Mb - 1Gb

A.1.11 Software Enclosure Services (SES) Support

The enclosure has a sophisticated self-monitoring and reporting function which conforms to ANSI SES specifications. This reports on such topics as:

- Enclosure temperature
- Fan speed
- Drive condition
- Operator panel status
- RAID controller status: not ready, partner fail, and partner present

For more information on the implementation of this function please request a copy of the SES specification from Technical Support.

A.2 Spare Parts and Accessories

The following replaceable parts are available for the enclosures:

- Chassis (including backplane and Ops Panel)
- 19-inch rack mounting rail kit
- AC power supply/cooling module
- Controller I/O module
- Blank I/O module
- Drive carrier module
- Dummy carrier module
- Keys for drive modules
- Various types of external FC-AL signal cables
- SFP module, optical
- SFP module, copper
- Battery, Li-ion
- (Country specific) power cords
- All documentation

B

Array Basics

EF2800 RAID controllers let you set up and manage disk arrays. A *disk array* (array) is a group of disks that appears to the system as a single virtual disk. This is accomplished through software resident in the RAID controller. RAID (Redundant Array of Independent Disks) refers to disk arrays in which part of the array storage capacity may be used to store redundant information. The redundant information lets you restore user data if a disk in the array fails.

The host system views the EF2800 system as a single FC disk drive. It is actually an array of physical disks behind a RAID controller. The EF2800 system is managed by software to appear as a single, very large physical disk. Depending on the array type, the virtual disk has advantages in fault-tolerance, cost, performance, or a combination of these. This section explains the different array types and the disk requirements for each type.

Tip: Choosing the right RAID level for your needs will improve performance. The following are examples of storage needs and appropriate RAID level. EF2800 RAID controllers also provide methods of tracking statistical data to aid in the process.

Figure 75 shows some example applications and RAID levels.

Figure 75. RAID Levels and Example Applications

RAID Level	Application
Volume	Testing multiple operating systems or software development (where redundancy is not an issue)
RAID 0	Fast temporary storage or scratch disks for graphics, page layout, and image rendering

Figure 75. RAID Levels and Example Applications

RAID Level	Application
RAID 1, 10	Workgroup servers
RAID 3 or 4	Video editing and production
RAID 5	Network operating system, databases, high availability applications, workgroup servers
RAID 50	Very large databases, Web server, video on demand

B.1 Array Types

Array types are defined by their RAID level, a number from 0 through 5 (a higher RAID level does not necessarily indicate a higher level of performance or fault tolerance). EF2800 RAID controllers let you create the types of arrays that have proven to be the most useful for RAID applications: RAID 0, 1, 10 (also known as mirrored), 3, 4, 5, 50, and volume sets.

For more detailed information about array types, refer to The RAID Book: A Storage System Technology Handbook by Paul Massiglia, ISBN 1-879936-90-9 or their web site at www.raid-advisory.com.

B.1.1 RAID 0 (Striped Disks)

In a RAID 0 array, data is distributed, or *striped*, across the disks in the array. The array appears to the server as one large disk with a capacity approximately equal to the combined capacity of the physical disks. Because multiple reads and writes can be handled in parallel, the I/O performance of the array is much better than that of a single physical disk.

RAID 0 arrays do not store redundant data, so they are not true RAID applications. If one disk fails, the entire array fails and all array data is lost. The fault tolerance of a RAID 0 array, therefore, is less than that of any single disk in the array. The term RAID 0 is widely used for these arrays, however, because they are conceptually similar to true RAID applications.

B.1.2 RAID 1, RAID 10 (Mirrored Disks)

In RAID 1 and RAID 10 arrays (commonly called *mirrored arrays*) disks are paired, with both disks in a pair containing the same data. When data is written to a mirrored array, it is written twice—once to each disk in the pair. A RAID 1 array has only one set of paired disks. A RAID 10 array has multiple pairs, across which data is striped.

The read performance of RAID 1 arrays can be much better than that of a single disk, while the write performance is slightly lower. In RAID 10 arrays, both read performance and write performance are better than those of a single disk.

A mirrored array is also highly reliable, because both disks *in a pair* must fail for the array to fail. In an array with five pairs of mirrored disks, for example, the array can maintain its integrity even if five disks fail; as long as each pair is left with one good disk. The main disadvantage of a mirrored array is its cost. Because all disks must have a twin, you must use twice the number of disks that actually contribute to the array capacity. In an eight-disk array, for example, you have only four disks of usable capacity.

B.1.3 RAID 3

RAID 3 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The user data is distributed across all but one of the disks in the array. The parity data is written exclusively to the *parity disk* (also known as the *check disk*). In the event of a disk failure, the data can be reconstructed from corresponding data stripes on the remaining disks in the array.

RAID 3 provides excellent I/O performance for applications that require high data transfer rates such as image processing, video processing, scientific data collection, batch data processing, or sequential reads and writes.

RAID 3 is not well suited for transaction processing or other applications that require simultaneous reads and writes.

B.1.4 RAID 4

RAID 4 is similar to RAID 3 in that the redundant information is achieved in the form of parity data. The user data is distributed across all but one of the disks. The EF2800 uses a single, dedicated parity drive for data protection. The main difference is that RAID 3 usually synchronizes writes to its disks, while RAID 4 can send data to its disk independently.

RAID 4 is best suited for transaction processing applications that require high read requests, but not write requests such as inquires rather than updates.

RAID 4 is not recommended for I/O-intensive applications that require high data transfer rates.

B.1.5 RAID 5

RAID 5 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. The parity information is distributed across the disks in the array and occupies the equivalent capacity of approximately one disk. Data is interspersed with the parity information. If one disk in the array fails, the data on the failed disk can be reconstructed from the parity data and user data on the remaining disks. Two disks must fail before the entire array fails.

The read performance of a RAID 5 array is excellent, comparable to that of a RAID 0 array. Write performance is lower than that of a RAID 0 array, because write operations involve calculating and writing new parity data as well as writing the new user data.

B.1.6 RAID 50

RAID 50 arrays are made up of two or more RAID 5 arrays, across which data is striped. RAID 50 arrays contain redundant information in the form of parity data, which is calculated block-by-block for all user data. As in a RAID 5 array, the parity information is distributed across the disks in the array and occupies the equivalent capacity of one disk per RAID 5. Data is interspersed with the parity information. If one disk in the array fails, the data on the failed disk can be reconstructed from the parity data and user data on the remaining disks. Two disks in one RAID 5 subset must fail before the entire array fails.

The read performance of a RAID 50 array is excellent—better than a RAID 5 array—along with better data protection. Write performance is lower than that of a RAID 0 array, because write operations involve calculating and writing new parity data as well as writing the new user data.

B.1.7 Volume Sets

A volume set provides the ability to create a host-accessible LUN that maps to a single disk in the array, similar to JBOD. Volume sets are non redundant and have a capacity slightly less than the physical disk they are created from. Volume sets are useful if you have a single disk available and you do not want to use it as a spare.

For more information on RAID levels, see *The RAIDbook: A Source Book for RAID Technology*, published by the RAID Advisory Board (St. Peter, Minnesota, February, 1996).

B.2 Comparing RAID Levels

Figure 76 illustrates the differences between the different RAID levels.

Figure 76. RAID Levels Comparison

RAID Level	Min. # of Drives	Description	Strengths	Weakness
RAID 0	2	Data striping without redundancy	Highest performance	No data protection — one drive fails, all data is lost
RAID 1	2	Disk mirroring	Very high performance and data protection, Minimal penalty on write performance	High redundancy cost overhead—because all data is duplicated, twice the storage capacity is required

Figure 76. RAID Levels Comparison

RAID Level	Min. # of Drives	Description	Strengths	Weakness
RAID 2	N/A	No practical use	Previously used for RAM error environments correction (known as Hamming Code) and in disk drives before the use of embedded error correction	No practical use—same performance can be achieved by RAID 3 at lower cost
RAID 3	3	Block-level data striping with dedicated parity drive	Excellent performance for large, sequential data requests	Not well-suited for transaction-oriented network applications; single parity drive does not support multiple, concurrent write requests
RAID 4 (not widely used)	3	Block-level data striping with dedicated parity drive	Data striping supports multiple simultaneous read requests	Write requests suffer from same single parity-drive bottleneck as RAID 3; RAID 5 offers equal data protection and better performance at same cost
RAID 5	3	Block-level data striping with distributed parity	Best cost/performance for transaction-oriented networks; very high performance and data protection; supports multiple simultaneous reads and writes; can also be optimized for large, sequential requests	Write performance is slower than RAID 0 or RAID 1

Figure 76. RAID Levels Comparison

RAID Level	Min. # of Drives	Description	Strengths	Weakness
RAID 50	6	Combination of RAID 0 (data striping) and RAID 5 with distributed parity	Better random performance and data protection than RAID 5; supports more drives than RAID 5	Lower storage capacity than RAID 5
RAID 10 (Also known as mirrored)	4	Combination of RAID 0 (data striping) and RAID 1 (mirroring)	Highest performance and data protection (can tolerate multiple drive failures)	High redundancy cost overhead; because all data is duplicated, twice the storage capacity is required; requires minimum of four drives
Volume Sets	1	Non-RAID, non-striped mapping to a single drive (similar to JBOD)	Ability to use a single drive to store additional data	Not protected, lower performance (not striped)

B.3 Mixing Disks from Different Manufacturers/ Capacities

An array can contain disks with different capacities; for example, an array can include a 36-GB disk and a 72-GB disk. If you mix disks with different capacities, the smallest disk determines the logical capacity of all other disks in the array, regardless of RAID level. For example, if a RAID 0 array contains one 36-GB disk and four 72-GB disks, the capacity of the array is equivalent to approximately five 36-GB disks. To maximize disk capacity, use disks of similar size.

NOTE: The manufacturer does not support mixing of different models, or manufacturer's, of drives in the same enclosure.

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C

Accessing Disk Array Administrator Software

The remaining appendices of the manual describe how to manage your EF2800 using the menu-based Disk Array Administrator.

You can display and change a variety of settings using the Disk Array Administrator software. Using the Disk Array Administrator, you can:

- Create and manage arrays
- Monitor system status
- Manage spares
- Configure the EF2800
- Manage disk drives and enclosures

You can access the Disk Array Administrator software using the RS-232 serial port or the Ethernet port connections on the SMs. You must connect a computer with terminal emulator software to the serial or Ethernet port.

Each SM has one RS-232 and one Ethernet port. You have access to all host and disk ports on all installed LRC I/O modules from either SM. However, you can only manage arrays and dedicated spares from the SM where the array was created, that is, each SM can only see its own arrays and dedicated spares. Each SM can see all pool spares and available drives (drives not used in an array or as a dedicated spare).

You must perform some configuration functions from the SM where you want the change to take place:

- Updating firmware
- Configuring LAN settings
- Creating and managing arrays, partitions, and dedicated spares

You can perform other configuration functions from either SM and have the same changes made automatically on the other SM:

- Managing pool spares
- Host channels configuration
- Disk channels configuration
- EF2800 settings:
  - Alarm mute
  - Lock cache
- Disk settings:
  - Write-back cache
  - SMART
  - Enclosure management processor (EMP)

C.1 Via the RS-232 Serial Port

You can access the Disk Array Administrator software using the RS-232 serial port. You must use a straight-through serial cable. You cannot use a null modem cable.

Configure the RS-232 port in your terminal emulator software using the following settings:

Setting	Value
Terminal Emulation	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

Set the communications parameters for the terminal program as follows:

Setting	Value
Baud Rate	115,200
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	Software (XON/XOFF) or None
Connector	COM1 (typically)

To access the Disk Array Administrator software using the RS-232 serial port:

1. From the computer connected to the EF2800, start your terminal emulation software.

   Be sure that your terminal emulation software is set to use the correct COM port on your computer. See section 10.13, "Terminal Emulator and COM Port Problems" on page 163 for more details on how the EF2800 can auto-detect the baud rate.

2. Press <Ctrl>-<R> to refresh the screen.

   The initial SM Disk Array Administrator screen appears (Figure 77).

Disk Array Administrator
EF2800
Menu Selection Help
No menu is active. When no menu is active, a rotating summary of the current controller status is displayed. Press <Enter> to display the main system menu.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:25:01 2003

Figure 77. Initial Disk Array Administrator Screen

If any events have occurred, each event displays. Informational events scroll by automatically. Warning events (yellow text on a black background) and error events (white text on a red background) display until you press <Enter> or <Esc>. Once all the events display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your EF2800.

You can bypass all events by pressing <Tab>. However, events provide valuable information about the status of your EF2800 and you should review them. All events are also stored in the event log (see section E.2, "Displaying the Event Log" on page 260).

3. Press <Enter>. The System Menu displays (Figure 78).

Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Menu Selection Help
System Menu. Select an array or perform a system-wide task. Menu options are enabled depending on the current system and array configuration.
SPECIAL KEYS: Arrow Keys or Hot Key = Select menu item
CTRL-A = ANSI/VT100 toggle CTRL-E = Next screen CTRL-R = Refresh terminal
CTRL-B = Color toggle CTRL-H = Help toggle CTRL-Z = Esc = Quit menu
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:26:25 2003

Figure 78. System Menu

You can now perform all of the functions described in the following chapters. All steps start from the System Menu.

C.2 Via the Ethernet Port

You can access the Disk Array Administrator software using the Ethernet port and Telnet. Windows users may want to obtain a terminal emulator program such as HyperTerminal Private Edition from Hilgraeve that supports both Telnet protocol and serial port protocol. In addition, such programs support the color display from the Disk Array Administrator.

You can configure a variety of settings for the Ethernet connection. For more information, see section I.2, "Configuring the LAN Settings" on page 322.

C.2.1 Set Up for First Time Use

Before you can access the Disk Array Administrator software, you must set the IP address and subnet mask for the SM. The default IP address is 10.0.0.1 and the default port number is 23. You can do this one of three ways:

- Setting up your computer with an IP address that is compatible with the EF2800 default of 10.0.0.1, such as 10.0.0.42.
- Using the serial connection to the SM and setting the address. See section I.2.1 "Configuring the IP Settings" on page 322.

Once you set the IP address and subnet mask, you can use the steps in the next section to access the Disk Array Administrator software.

C.2.2 Procedure

NOTE: You can use the RS-232 and Telnet connections at the same time. If a Telnet session is active, you can see the activity through the RS-232 connection, and you can make changes to the configuration using the RS-232 connection.

You can configure a variety of settings for the Ethernet connection. For more information, see section I.2, "Configuring the LAN Settings" on page 322.

To access the Disk Array Administrator software using the Ethernet port and the Telnet utility:

4. Set up the IP address and subnet mask as described in section C.2.1, "Set Up for First Time Use" on page 197.

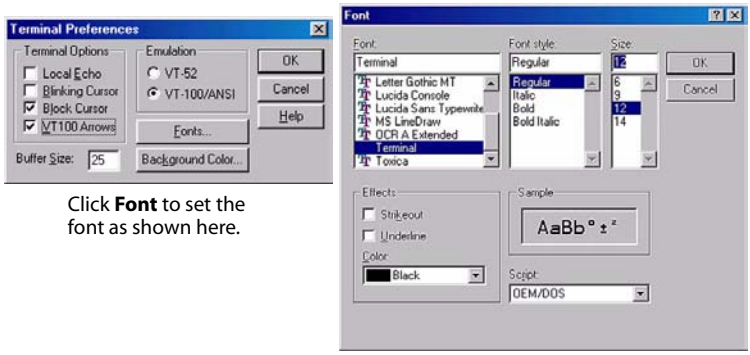
5. At the DOS or UNIX prompt, type **telnet** and press <Enter>.

   The exact steps for your Telnet program may be different. The remaining steps work for HyperTerminal Private Edition.

6. Using the **Terminal** menu, select **Preferences**.

7. Select **VT100 Arrows** option, **VT-100/ANSI** emulation, and **Terminal** font (Figure 79). Click **OK**.

   If you are using Windows and Telnet, you must configure the preferences and font from the Terminal menu each time as shown below.



Click **Font** to set the font as shown here.

Figure 79. Select Terminal Font

8. Enter the IP address or, using the **Connect** menu, select the EF2800 IP address from the menu (if present) and press <Enter>.

   If needed, enter the port number. The default port is 23.

9. At the Enter Password screen. Enter your password and press <Enter>. There is no default password. If you have not set up a password, just press <Enter>.

   The initial Disk Array Administrator screen appears (Figure 80). If any events have occurred, each event displays. Informational events scroll by automatically. Warning events (yellow text on a

black background) and error events (white text on a red background) display until you press <Enter> or <Esc>. Once all the events display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your EF2800.

Disk Array Administrator
EF2800
Menu Selection Help
No menu is active. When no menu is active, a rotating summary of the current controller status is displayed. Press <Enter> to display the main system menu.
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:25:01 2003

Figure 80. Disk Array Administrator Initial Screen

You can bypass all events by pressing <Tab>. However, events provide valuable information about the status of your EF2800 and you should review them. All events are also stored in the event log (see section E.2, "Displaying the Event Log" on page 260).

10. Press <Enter>. The System Menu displays (Figure 81).

You can now perform all of the functions described in the following chapters. All steps start from the System Menu.

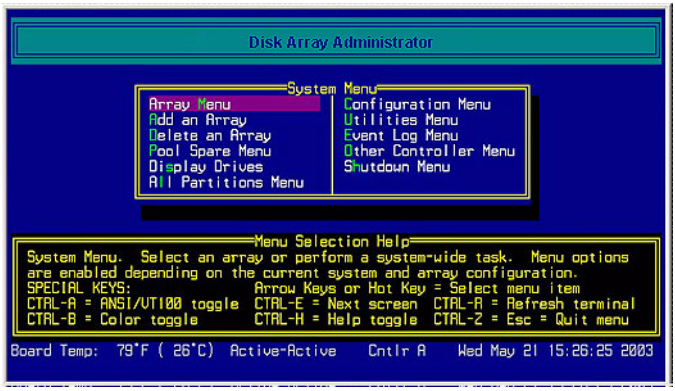

Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Array
Pool Spare Menu
Display Drives
All Partitions Menu
Configuration Menu
Utilities Menu
Event Log Menu
Other Controller Menu
Shutdown Menu
Menu Selection Help
System Menu. Select an array or perform a system-wide task. Menu options are enabled depending on the current system and array configuration.
SPECIAL KEYS: Arrow Keys or Hot Key = Select menu item
CTRL-A = ANSI/VT100 toggle CTRL-E = Next screen CTRL-R = Refresh terminal
CTRL-B = Color toggle CTRL-H = Help toggle CTRL-Z = Esc = Quit menu
Board Temp: 79°F (26°C) Active-Active Cntlr A Wed May 21 15:26:25 2003

Figure 81. System Menu

C.3 Navigating the Disk Array Administrator Software

You can navigate the Disk Array Administrator software using your keyboard. Figure 82 describes the primary navigation and selection methods.

Figure 82. Disk Array Administrator Navigation

To	Do this
Select a menu item	Press the ↑ or ↓ and press <Enter>; or Press the letter that is highlighted in a menu item (hot key).
Return to the previous menu or screen without saving your changes	Press <Esc>, <Ctrl>-<Z>, or ←.
Scroll through the available choices for a setting	Press the ↑ or ↓.
Bypass the list of recent events	Press <Tab>

NOTE: After four minutes of inactivity, the Disk Array Administrator software times out and returns to the initial screen.

C.3.1 Changing the Screen Display

After you have accessed the Disk Array Administrator software, you can change the screen display using a combination of keystrokes, as shown on the System Menu. Figure 83 lists the keystrokes required to change various screen displays.

Figure 83. Changing Screen Displays

Select	Function
Ctrl-A	Toggles between ANSI and VT100 character sets (use VT100 for legacy systems)

Figure 83. Changing Screen Displays (Continued)

Select	Function
Ctrl-B	Toggles between black and white and color
Ctrl-E	Toggles between the event log, hardware information, and configuration information screens
Ctrl-H	Toggles between the Help screen and list of shortcut keys
Ctrl-R	Refreshes screen
Ctrl-Z, Esc, or ←	Escapes or quits the current menu

C.3.2 Disk Array Administrator Menu Tree

Figure 84 and Figure 85 describe the complete Disk Array Administrator menu hierarchy. In the Disk Array Administrator, menu options that are not accessible appear gray. For example, the **Array Menu** is not accessible unless one or more arrays exist.

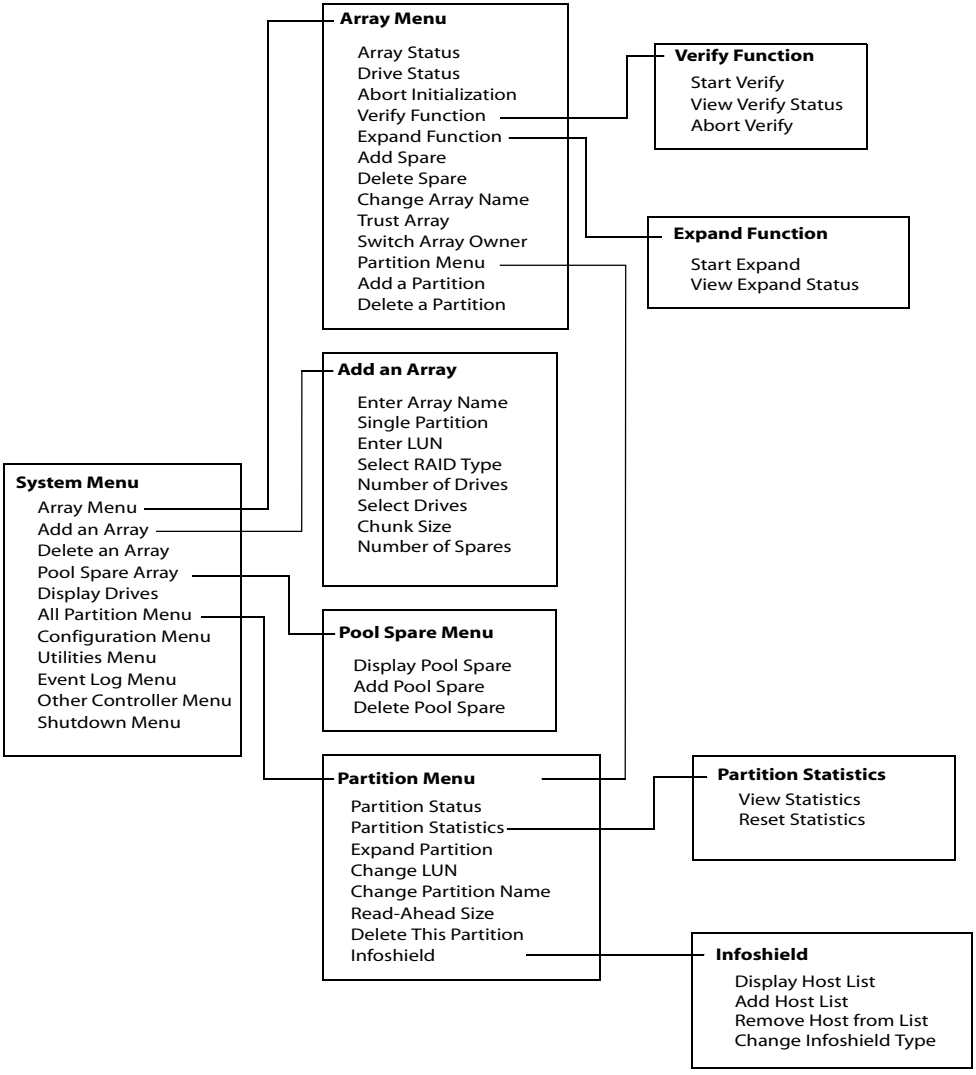


Figure 84. Menu Tree (1 of 2)

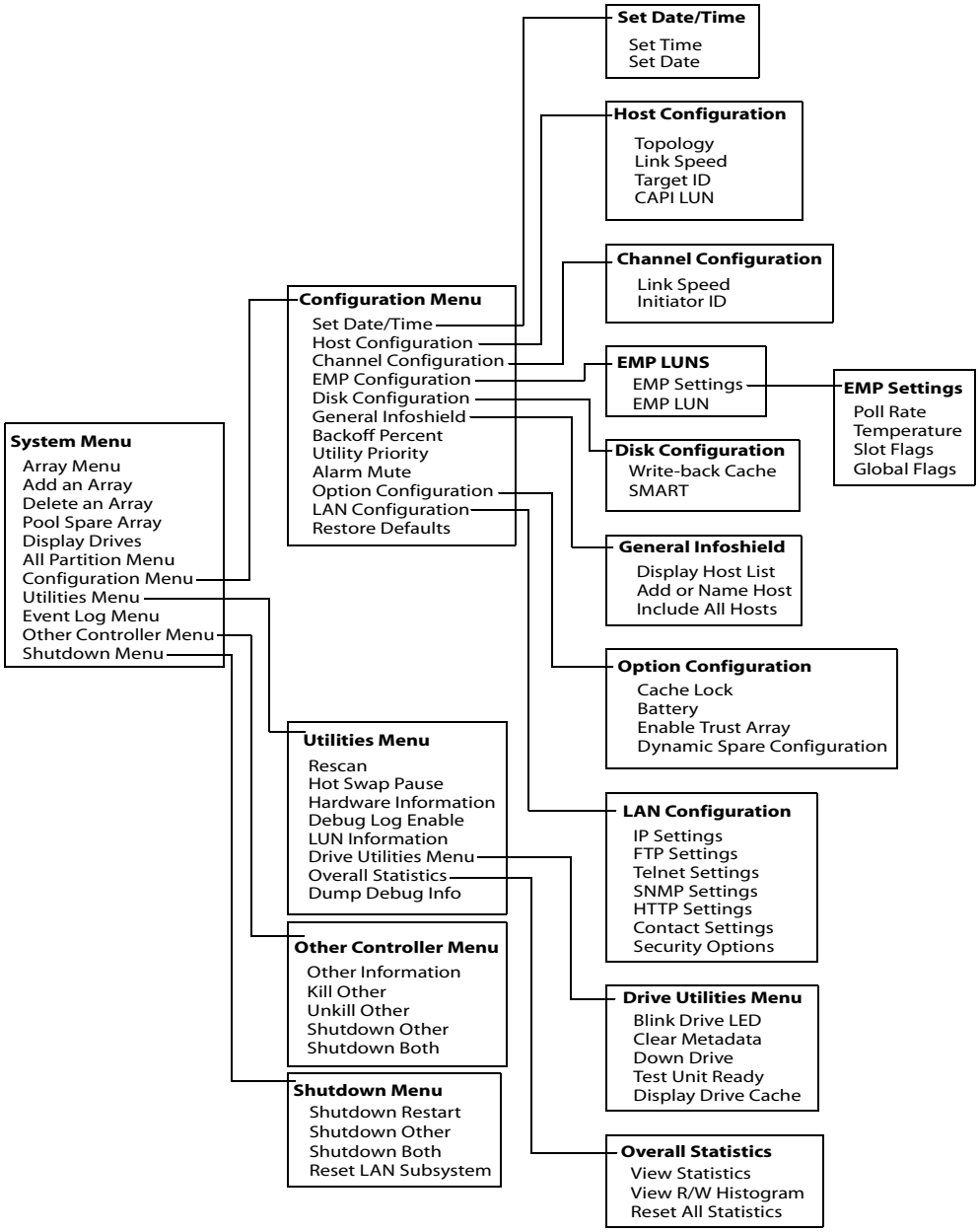


Figure 85. Menu Tree (2 of 2)

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D

Creating and Managing Arrays & Partitions

Using the Disk Array Administrator, you can create and manage arrays and partitions. You can perform the following array-related functions:

- Create arrays (see page 205)
- Manage arrays (see page 218)
- Manage partitions (see page 235)

D.1 Creating Arrays

You can create an array anytime. You can create arrays from either SM A or SM B. Arrays you create from one SM are not visible through the RS-232 or Ethernet port of the other SM. However, all unused disk drives connected to all LRC I/O modules and all pool spares are available to both SMs.

The maximum size for any array is 2TB. Figure 86 shows the drive requirements for each RAID level.

Figure 86. Drive requirements by RAID level

RAID level	Min. # of Drives	Max. # of drives
Volume Set	1	1
RAID 0	2	16
RAID 1 (Mirrored)	2	16

Figure 86. Drive requirements by RAID level

RAID level	Min. # of Drives	Max. # of drives
RAID 3	3	16
RAID 4	3	16
RAID 5	3	16
RAID 50	6	32

NOTE: Before you create more than one array, you must be sure that your host operating system supports multiple logical unit numbers (LUNs). Most operating systems do, or have an option you can enable to support multiple LUNs. If your operating system does not support multiple LUNs, the host will only be able to see one array at LUN 0.

Before you create an array, you must decide whether you want to partition the array. You can create an array one of two ways:

- As a **single-partition array**: an array that stores all data in a single partition and is accessed by a single LUN.
- As a **multiple-partition array**: an array that can have one or more partitions, with each partition assigned its own LUN.

For more information about partitions, see section D.3.1, "Understanding Partitions" on page 235.

D.1.1 Creating a Single-Partition Array

You can create an array that has just one partition. Once you create a single-partition array, you cannot add more partitions. Single-partition arrays work well in environments that need one large, fault-tolerant storage space for data on one server. A large database accessed by users on a single server that is used only for that application is an example.

To create a single-partition array:

1. From the System Menu, select **Add an Array** and press <Enter>. The Enter Array Name screen displays (Figure 87).

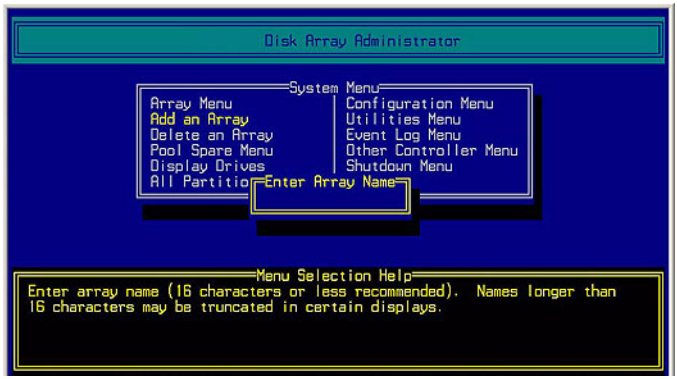


Figure 87. Enter Array Name Screen

2. Enter a name for the array and press <Enter>.
   You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the array, you can just press <Enter>. You can add or change the name later.

3. The system asks if you want to create one partition now for the entire array. Select **Yes** to create a single-partition array and press <Enter>. The LUN screen displays (Figure 88).

   If you want to create a multiple-partition array, see section D.1.2 on page 212.

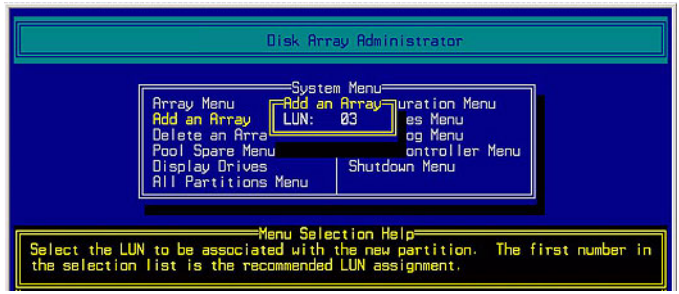


Figure 88. Select LUN for Array

4. Select the LUN for the array and press <Enter>. The LUN that displays is the suggested default LUN assignment.

NOTE: Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the controller (this application uses CAPI to communicate with the EF2800), you must have a CAPI LUN. If you are not using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

The system warns you about the LUN for UNIX and Macintosh, as above, the first time you create an array. Press <Enter> and the system asks if you want to be warned again. Select **No** to avoid receiving this warning again or select **Yes to be** warned the next time you create an array.

The RAID Type screen displays (Figure 89).

Figure 89. Select RAID Type for Array

5. Select a RAID type: **RAID0**, **RAID3, RAID4, RAID5, RAID50, VOLUME** (a single drive similar to just a bunch of disks [JBOD] except that it includes metadata), or **MIRRORED** and press <Enter>.

NOTE: A RAID 10 array is created when there are more than two drives in a mirrored array.

See Appendix B, "Array Basics" on page 185 for more information.

If you selected **RAID 50** as the array type, the Select RAID 50 Array Size screen will appear with all possible configurations for the

array and drive combinations. Select the configuration you want, press <Enter>, and skip the next step.

If you selected any array type other than RAID 50, the Number of Drives screen displays (Figure 90).

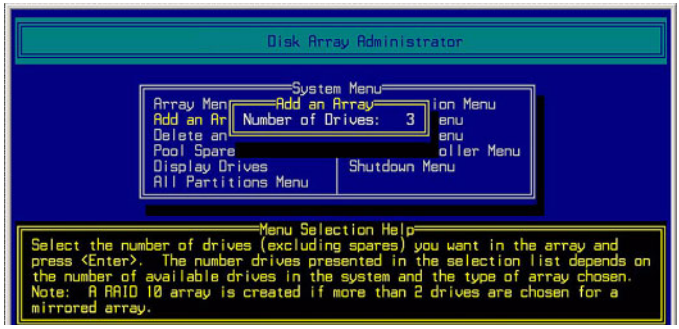

Disk Array Administrator
System Menu
Array Men
Add an Ar
Delete an
Pool Spare
Display Drives
All Partitions Menu
Add an Array
Number of Drives: 3
ion Menu
enu
enu
oller Menu
Shutdown Menu
Menu Selection Help
Select the number of drives (excluding spares) you want in the array and press <Enter>. The number drives presented in the selection list depends on the number of available drives in the system and the type of array chosen.
Note: A RAID 10 array is created if more than 2 drives are chosen for a mirrored array.

Figure 90. Select Number of Drives for Array

6. Enter the number of drives (excluding spares) you want for the array and press <Enter>. The Select Drives screen displays (Figure 91).

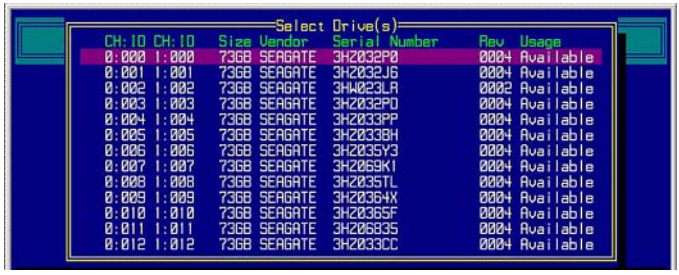

Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 73GB SEAGATE 3HZ032P0 0004 Available
0:001 1:001 73GB SEAGATE 3HZ032J6 0004 Available
0:002 1:002 73GB SEAGATE 3HW023LA 0002 Available
0:003 1:003 73GB SEAGATE 3HZ032PD 0004 Available
0:004 1:004 73GB SEAGATE 3HZ033PP 0004 Available
0:005 1:005 73GB SEAGATE 3HZ0338H 0004 Available
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ0364X 0004 Available
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06B35 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available

Figure 91. Select Drives for Array

The list includes all available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool spare, on either SM. The screen includes information for each drive: Loop ID for each channel (------ indicates a single ported drive), Size, Vendor, Model or serial number or node and WWN (press <T> to toggle the display), Rev (firmware revision), Usage, and Usage.

7. Select the drives you want to use for the array and press <Enter>.

   Use the ↑ or ↓ key to scroll through the list and press <Enter> to select it. Each selected drive turns gray in the drive list. After you selected the correct number of drives, the system automatically goes to the next screen.

   You may want to select drives from different disk channels (I/O modules), which keeps the array online even if one channel becomes unavailable.

   If the array is mirrored, RAID 3, RAID 4, RAID 5, or RAID 50 *and* you have one or more drives left, the Number of Spares screen displays.

8. If the Number of Spares screen displays, enter the number of spares you want to add and press <Enter>. This creates dedicated spares that can only be used by this array. A dedicated spare drive will not be available for any other use. If you do not want a dedicated spare, enter **0**.

   The Select Drives screen displays.

9. If the Select Drives screen displays, select the drive you want to use as a dedicated spare and press <Enter>.

   Only available drives, that is, drives that are not members of an array and are not assigned as dedicated or pool spares, will be displayed. You can delete a dedicated spare from the array at any time. For more information, see section F.1.2 on page 277.

   Use the ↑ or ↓ key to scroll through the list and press <Enter> to select it. Each selected drive turns gray in the drive list. After you selected the correct number of drives, the system automatically goes to the next screen.

   To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.

   If the array you are creating is a RAID 0, RAID 3, RAID 4, RAID 5, RAID 10, or RAID 50, the Chunk Size screen displays (Figure 92).

Figure 92. Select Chunk Size for Array

10. If the Chunk Size screen displays, select the chunk size and press <Enter>.

The chunk size is the amount of contiguous data that is written to an array member before moving to the next member of the array. To determine the appropriate chunk size, refer to your operating system documentation. For example, the default chunk size for Windows NT and many other operating systems is 64 KB. If you are using the array for a database with very small records, you may want to use a smaller chunk size.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 50, or Mirrored, the Array Init Options screen displays. The current option has an * next to it.

11. If the Array Init Options screen displays, select the option you want and press <Enter>.

- Offline Initialization: Using this option means you must wait for the array initialization process to finish before using the array. It uses the zero method to create the array, which is faster than the verify method.
- Online Initialization: Using this option lets you begin using the array immediately after creating it, while the array initialization process runs. It uses the verify method to create the array, which takes longer than the zero method.

12. The system prompts you to confirm array creation. Select **Yes** and press <Enter>.

A message notifies you that the array is being created and shows the progress of the initialization process. The array initialization process takes from several minutes to more than an hour

depending on the array type (volume, RAID 0, and RAID 1 are the fastest), array size, drive speed, and other processes running on the EF2800.

You can press <Esc> to return to the Disk Array Administrator menus and perform other functions. To check the progress of the array initialization, select **Array Menu** from the System Menu. The status of the initialization displays in the list of arrays.

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process. See section D.2.2 on page 222.

NOTE: Most operating systems, such as Windows NT 4.0, require you to restart the host system to see a new LUN. Windows 2000 can recognize new LUNs by selecting Refresh from the Computer Management Window. NetWare v3.12 and later can recognize new devices by typing the command SCAN FOR NEW DEVICES at the console prompt. Other operating systems might have similar features.

D.1.2 Creating a Multiple-Partition Array

You can create an array that is set up for more than one partition.

NOTE: Once you create a multiple-partition array, you must create at least one partition before you can use the array. See section D.2.3 on page 222.

Multiple-partition arrays work well when you have very large disk drives and you want to make the most efficient use of disk space for fault tolerance (parity and spares). For more information, see section D.3.1 on page 235.

To create a multiple-partition array:

1. From the System Menu, select **Add an Array** and press **Enter**. The Enter Array Name screen displays (Figure 93).

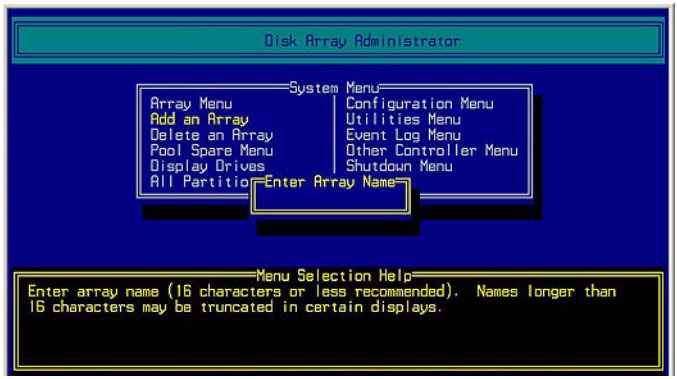


Figure 93. Enter Array Name Screen

2. Enter a name for the array and press <Enter>.
   You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the array, you can just press <Enter>. You can add or change the name later.

3. The system asks if you want to create one partition now for the entire array. Select **No** to create a multiple-partition array and press <Enter>.

   If you want to create a single-partition array, see D.1.1 on page 206.

4. The RAID Type screen displays (Figure 94).

Figure 94. Select RAID Type for Array

5. Select the RAID type: **RAID0, RAID3, RAID4, RAID5, RAID50, VOLUME** (a single drive similar to just a bunch of disks (JBOD) except that it includes metadata), or **MIRRORED** and press <Enter>.

NOTE: A RAID 10 array is created when there are more than two drives in a mirrored array.

See Appendix B, "Array Basics" on page 185 for more information.

If you selected RAID 50 as the array type, the Select RAID 50 Array Size screen displays (not shown) with all possible configurations for the array and drive combinations. Select the configuration you want, press <Enter>, and skip the next step.

If you selected any array type other than RAID 50, the Number of Drives screen displays.

Disk Array Administrator
System Menu
Add an Array
Number of Drives: 3
Shutdown Menu
Menu Selection Help
Select the number of drives (excluding spares) you want in the array and press <Enter>. The number drives presented in the selection list depends on the number of available drives in the system and the type of array chosen.
Note: A RAID 10 array is created if more than 2 drives are chosen for a mirrored array.

Figure 95. Select Number of Drives for Array

6. Enter the number of drives (excluding spares) you want in the array and press <Enter>. The Select Drives screen displays (Figure 96).

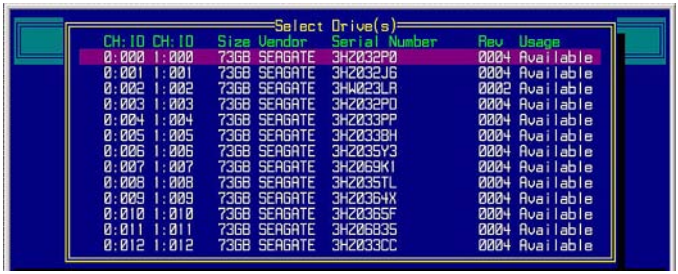

Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 73GB SEAGATE 3HZ032P0 0004 Available
0:001 1:001 73GB SEAGATE 3HZ032JG 0004 Available
0:002 1:002 73GB SEAGATE 3HW023LR 0002 Available
0:003 1:003 73GB SEAGATE 3HZ032PD 0004 Available
0:004 1:004 73GB SEAGATE 3HZ033PP 0004 Available
0:005 1:005 73GB SEAGATE 3HZ033BH 0004 Available
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ036HX 0004 Available
0:010 1:010 73GB SEAGATE 3HZ036SF 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06835 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available

Figure 96. Select Drives for Array

The list includes all available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool

spare, on either SM. The screen includes information for each drive: Loop ID for each channel (------ indicates a single ported drive), Size, Vendor, Model or serial number or node and WWN (press <T> to toggle the display), Rev (firmware revision), Usage, and Usage.

7. Select the drives you want to use for the array and press <Enter>.

   Use the ↑ or ↓ key to scroll through the list and press <Enter> to select it. Each selected drive turns gray in the drive list. After you selected the correct number of drives, the system automatically goes to the next screen.

   You may want to select drives from different disk channels (I/O modules), which keeps the array online even if one channel becomes unavailable.

   If the array is mirrored, RAID 3, RAID 4, RAID 5, or RAID 50 *and* you have one or more drives left, the Number of Spares screen displays.

8. If the Number of Spares screen displays, enter the number of spares you want to add and press <Enter>.

   This creates dedicated spares that can only be used by this array. A dedicated spare drive will not be available for any other use. If you do not want a dedicated spare, enter **0**.

   The Select Drives screen displays.

9. If the Select Drives screen displays, select the drive you want to use as a dedicated spare and press <Enter>.

   Only available drives, that is, drives that are not members of an array and are not assigned as a dedicated or pool spares, will be displayed. You can delete a dedicated spare from the array at any time. For more information, see section F.1.2 on page 277.

   Use the ↑ or ↓ key to scroll through the list and press <Enter> to select it. Each selected drive turns gray in the drive list. After you selected the correct number of drives, the system automatically goes to the next screen.

To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 10, or RAID 50, the Chunk Size screen displays (Figure 97).

Figure 97. Select Chunk Size for Array

10. If the Chunk Size screen displays, select the chunk size and press <Enter>.

The chunk size is the amount of contiguous data that is written to an array member before moving to the next member of the array. To determine the appropriate chunk size, refer to your operating system documentation. For example, the default chunk size for Windows NT and many other operating systems is 64 KB. If you are using the array for a database with very small records, you may want to use a smaller chunk size.

If the array you are creating is a RAID 3, RAID 4, RAID 5, RAID 50, or Mirrored array, the Array Init Options screen displays. The current option has an * next to it.

11. If the Array Init Options screen displays, select the option you want and press <Enter>.

- Offline Initialization: Using this option means you must wait for the array initialization process to finish before using the array. It uses the zero method to create the array, which is faster than the verify method.
- Online Initialization: Using this option lets you begin using the array immediately after creating it, while the array initialization process runs. It uses the verify method to create the array, which takes longer than the zero method.

12. The system prompts you to confirm array creation. Select **Yes** and press <Enter>.

    A message notifies you that the array is being created and shows the progress of the initialization process. The array initialization process takes from several minutes to more than an hour depending on the array type (volume, RAID 0, and RAID 1 are the fastest), array size, drive speed, and other processes running on the EF2800.

You can press <Esc> to return to the Disk Array Administrator menus and perform other functions. To check the progress of the array initialization, select **Array Menu** from the System Menu. The status of the initialization displays in the list of arrays.

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process. See section D.2.2 on page 222.

You must create at least one partition before you can use the array. See section D.2.3 on page 222.

NOTE: Most operating systems, such as Windows NT 4.0, require you to restart the host system to see the new array. Windows 2000 can recognize new LUNs by selecting Refresh from the Computer Management Window. NetWare v3.12 and later can recognize new devices by typing the command SCAN FOR NEW DEVICES at the console prompt. Other operating systems might have similar features.

D.2 Managing Arrays

The Disk Array Administrator software lets you manage your arrays in a variety of ways. You can:

- View array and drive status (see page 218)
- Stop the initialization process (see page 222)
- Add a partition (see page 222)
- Verify an array (see page 225)
- Reconstruct an array (see page 227)
- Expand array capacity (see page 243)
- Change the array name (see page 231)
- Change array ownership (see page 231)
- Trust an array (see page 232)
- Delete an array (see page 234)

D.2.1 Viewing Array and Drive Status Information

Array and drive status information is available in two ways:

- View array status (see page 218)
- View drive status (see page 220)

D.2.1.1 Viewing Array Status

You can view the status of an array, including the following information:

- State: Online, Offline, Critical, or Fault-tolerant.
- Serial number: Unique number the EF2800 assigns to each array.
- Name: Name you give to the array.
- RAID level: Array type (0, 3, 4, 5, 50, Volume, or Mirrored). The term “mirrored” is used for both RAID 1 and RAID 10 arrays.
- Number of drives: Number of drives in the array when fault-tolerant. For example, if a three-drive RAID 5 array loses one drive, the number will still display 3.
- Number of drives per subarray: For RAID 50 only; number of drives in each underlying RAID 5 array.

- Number of spare drives: Number of spare drives dedicated to this array.
- Size: Size of the entire array (expressed in MB or GB for arrays larger than 10 GB).
- Chunk size: Array's chunk size.
- Date created: Date the array was created.
- Utility: Utility running (None, Verify, Reconstruct, Expand, or Initialize).
- Number of partitions: Number of partitions created on the array.
- Free partition total: Amount of free space (no partition) on the array.

To view the status of an array:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays (Figure 98).

Figure 98. Select Array Screen

2. Select the array you want and press <Enter>. The Array menu displays (Figure 99).

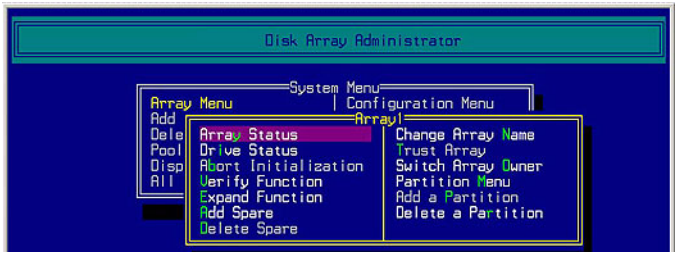


Figure 99. Array Menu

3. Select **Array Status** and press <Enter>. The status screen appears, showing the status of the array you selected (Figure 100).

Figure 100. Array Status Screen

4. Press <Esc> to return to the Array Menu.

D.2.1.2 Viewing Drive Status

You can view the status of the drives in an array, including the following information:

- Drive number: The drive's sequential position in the EF2800's drive list.
- Drive status: Whether the drive is up or down.
- Spare: SPR identifies the drive as a dedicated spare.
- Channel number: Back-end disk bus number.
- Channel: ID
- Size: Size of the drive in MB.
- Usage: If part of an array, this displays the array name and member number. If a spare, this displays the type of spare. If unused, this displays Available. If the drive was part of an array that no longer exists, this displays Leftover.

NOTE: If a drive has failed or malfunctioned, it may not be listed.

To view drive status:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays (Figure 101).

Figure 101. Select Array Screen

2. Select the array you want and press <Enter>. The array menu displays (Figure 102).

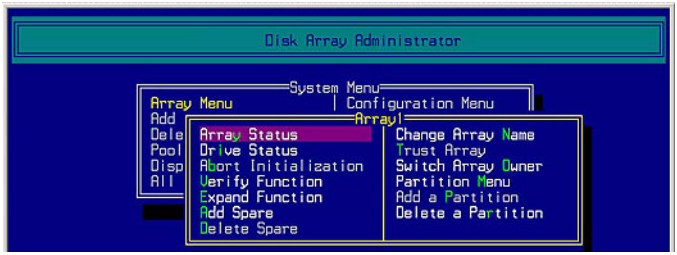


Figure 102. Array Menu

3. Select **Drive Status** and press <Enter>. The drive status screen displays showing the drives that are members of the array and that are assigned as dedicated spares (Figure 103).

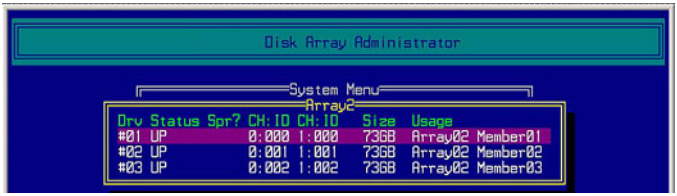

Disk Array Administrator
System Menu
Array2
Drv Status Spr? CH:ID CH:ID Size Usage
#01 UP 0:000 1:000 73GB Array02 Member01
#02 UP 0:001 1:001 73GB Array02 Member02
#03 UP 0:002 1:002 73GB Array02 Member03

Figure 103. Drive Status Screen

Use the ↑ or ↓ key to scroll through the drives. These are the drives that are currently members of the array.

4. Press <Esc> to return to the Array Menu.

D.2.2 Stopping the Array Initialization Process

If you find that you need to change the disks or some other array configuration, you can stop the array initialization process.

Caution ! If you stop the initialization process, the array goes offline and its data is not available to users.

You must delete the array before you can use the drives in another array.

To stop the array initialization process:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Abort Initialization** and press <Enter>. The system confirms that you want to stop the initialization process.
4. Select **Yes** and press <Enter>.

D.2.3 Adding a Partition

If you created a multiple-partition array, you must create at least one partition on the array before you can use the array. You can create partitions on a multiple-partition array until you use all of the free space. For more information about partitions, see section D.3.1 on page 235.

To add a partition:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the multiple-partition array you want and press <Enter>. The Array menu displays.

3. Select **Add a Partition** and press <Enter>. The Select Free Partition screen displays with a list of free partitions (Figure 104). A free partition is the free space that has not yet been partitioned or space that had a partition that was deleted.

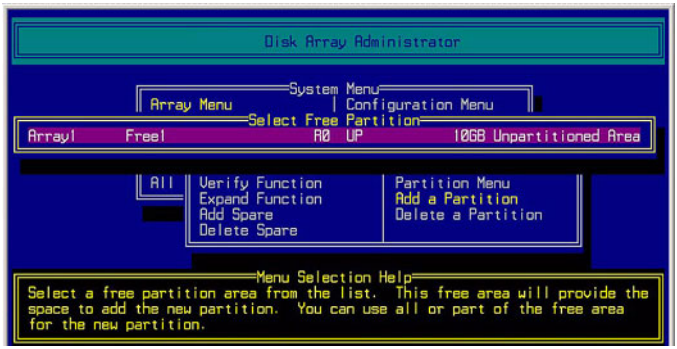

Disk Array Administrator
System Menu
Array Menu
Configuration Menu
Select Free Partition
Array1 Free1 A0 UP 10GB Unpartitioned Area
All
Verify Function
Expand Function
Add Spare
Delete Spare
Partition Menu
Add a Partition
Delete a Partition
Menu Selection Help
Select a free partition area from the list. This free area will provide the space to add the new partition. You can use all or part of the free area for the new partition.

Figure 104. Select Free Partition Screen

4. Select the free partition you want to use. The Partition Size screen displays (Figure 105).

Disk Array Administrator
System Menu
Array Menu
Configuration Menu
Array1
Add
Dele
Array Status
Change Array Name
Add a Partition
10,452MB (Remaining: 0MB, Maximum: 10,452MB)
Add Spare
Delete Spare
Delete a Partition
Menu Selection Help
Enter the size of the new partition in megabytes (MB). The menu displays the number of MB remaining in the free area, the maximum number of MB that can be used. The number of MB remaining is updated "on the fly" as digits are entered.
NOTE: In this display 1MB = 1,048,576 (2e20) bytes.

Figure 105. Enter Partition Size Screen

5. Enter the size you want to make the partition and press <Enter>. The Partition Name screen displays (Figure 106).

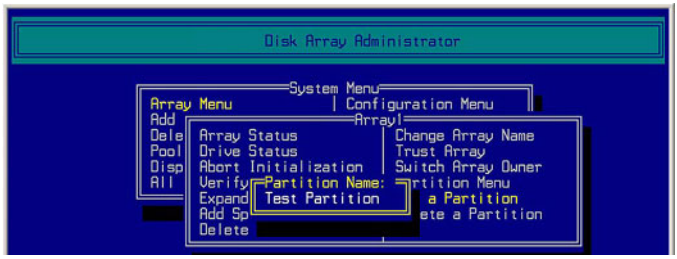


Figure 106. Enter Partition Name Screen

6. Enter a name for the partition and press <Enter>. You can use up to 20 characters. You can include any characters in the name, including spaces. If you do not want to name the partition, you can just press <Enter>. You can add or change the name later.

   The LUN screen displays (Figure 107).

Figure 107. Select LUN for Partition

7. Select the LUN for the partition and press <Enter>. The LUN displayed is the suggested default LUN assignment.

NOTE: Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN, which is the LUN assigned to each SM, be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the EF2800 subsystem (this application uses CAPI to communicate with the EF2800), you must have a CAPI LUN. If you are not

using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

The system warns you about the LUN for UNIX and Macintosh, as above, the first time you create a partition. Press **Enter** and the system asks if you want to be warned again. Select **No** to avoid receiving this warning again, otherwise select **Yes** to be warned the next time you create a partition.

The system prompts you to confirm changes.

8. Select **Yes** and press <Enter>.

D.2.4 Verifying an Array

The Verify function allows you to verify the data on the specified array (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored arrays only):

- RAID 3, RAID 4, RAID 5 and RAID 50*:* Verifies all parity blocks in the selected array and corrects any bad parity.
- Mirrored: Compares the primary and secondary drives. If a mismatch occurs, the primary is copied to the secondary.

You may want to verify an array when you suspect there is a problem.

To verify an array:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The Array menu displays.
3. Select **Verify Function** and press <Enter>. The Verify menu displays (Figure 108).

Figure 108. Verify LUN Screen

4. Select **Start Verify** and press <Enter>. Verification begins and the percentage of verification completed displays (Figure 109). You can continue to use the array during verification.

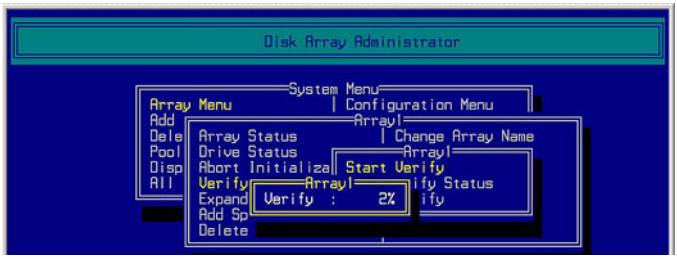


Figure 109. Verify Progress Screen

To return to the verification menu, press <Esc>. To check the progress of the array verification, you can use the verification status described below or select **Array Menu** from the System Menu. The status of the verification displays in the list of arrays.

D.2.4.1 Viewing Verification Status

You can view the status of the verification process while it is running.

To view verification status:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Verify Function** and press <Enter>. The verify menu displays.

4. Select **View Verify Status** and press <Enter>. The verify menu displays.

5. Press <Esc> to return to the Verify menu.

D.2.4.2 Stopping the Verification

You can stop the verification process. Normally, you want to let the verification finish, although stopping it does *not* cause any damage to your data. You may want to stop the verification if you want to improve performance of the EF2800 for another application.

To stop the verification process:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press <Enter>. The array menu displays.

3. Select **Verify Function** and press <Enter>**.** The verify menu displays.

4. Select **Abort Verify** and press <Enter>. The system confirms that you want to stop the verification process.

5. Select **Yes** and press <Enter>.

D.2.5 Reconstructing an Array

.The EF2800 automatically reconstructs redundant arrays (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fail.

If a reconstruct does not start automatically, it means that no valid spares are available. To start a reconstruct, replace the failed drive, and add the new drive as a dedicated spare (see sections F.1.1, "Adding a Dedicated Spare" on page 276 and F.2, "Enabling Dynamic Spares" on page 278) or as a pool spare (see section F.3.1, "Adding a Spare to the Spare Pool" on page 280). Remember that any pool spares added might be used by any critical array, not necessarily the array you want.

D.2.6 Expanding Array Capacity

You can expand array capacity without stopping I/O activity, so you can continue using the array while the expansion process runs. You can only expand one array at a time.

Notes:

- Expanding an array here does not change the size of the host operating system partitions that reside on the array, because the RAID controller is working at the block level not the file system level of the operating system. To use the new space, you must create a new operating system partition using the newly added space or use a third-party application specific to the operating system to change the partition size.
- How you create a new partition or resize an existing one depends upon the operating system. Most operating systems cannot resize an existing partition. Refer to your operating system documentation.

The number of drives you can add to an array depends upon the RAID level as shown in Figure 110. You also cannot exceed the maximum number of drives for each RAID level (see section D.1, "Creating Arrays" on page 205).

Figure 110. Drive additions by RAID level

RAID Level	Number of drives you can add	Max. # of drives
RAID 0	1 to 4 at a time up to the maximum	16
RAID 1 (Mirrored)	Cannot expand	N/A
Volume Set	Cannot expand	N/A
RAID 10	2 or 4 at a time up to the maximum	16
RAID 3, 4, or 5	1 to 4 at a time up to the maximum	16
RAID 50	You can expand the array, one RAID 5 array at a time up to the maximum number of drives. All RAID 5 arrays must contain the same number of drives.	32

If you are expanding a multiple-partition array, you add free space at the end of the array. For more information about partitions, see section D.3.1, "Understanding Partitions" on page 235.

NOTE: Once you start expanding array capacity, you cannot stop it. The expand function may take an hour or more to complete, depending on the array type, array size, drive speed, and other processes running on the EF2800.

To expand an array:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press <Enter>. The array menu displays.

3. Select **Expand Function** and press <Enter>. The expand menu displays.

4. Select **Start Expand** and press <Enter>. The Number of Drives screen displays (Figure 111).

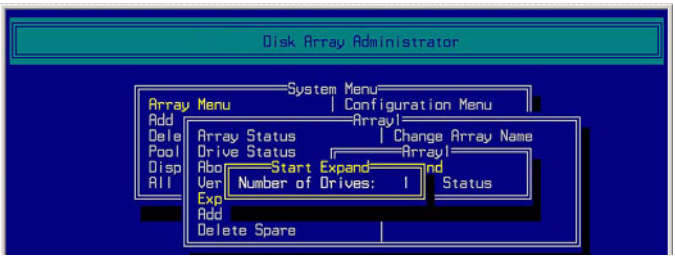
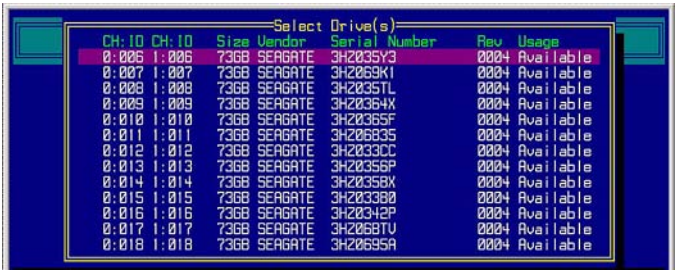


Figure 111. Select Number of Drives for Expansion

5. Enter the number of drives you want to add and press **Enter**. The Select Drives screen displays (Figure 112).


Select Drive(s)
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Available
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Available
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Available
0:009 1:009 73GB SEAGATE 3HZ0364X 0004 Available
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Available
0:011 1:011 73GB SEAGATE 3HZ06835 0004 Available
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Available
0:013 1:013 73GB SEAGATE 3HZ0356P 0004 Available
0:014 1:014 73GB SEAGATE 3HZ0358X 0004 Available
0:015 1:015 73GB SEAGATE 3HZ033B0 0004 Available
0:016 1:016 73GB SEAGATE 3HZ0342P 0004 Available
0:017 1:017 73GB SEAGATE 3HZ06BTV 0004 Available
0:018 1:018 73GB SEAGATE 3HZ0695A 0004 Available
Figure 112. Select Drives for Expansion

6. Select the drives you want to add from the list of available drives and press <Enter>. Only available drives, that is, drives that are not members of an array and are not assigned as dedicated or pool spares, are displayed.

   Use the ↑ or ↓ key to scroll through the list and press <Enter> to select it. Each selected drive turns gray in the drive list. After you selected the correct number of drives, the system automatically begins the expansion.

   To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.

Expansion begins and the percentage completed displays. To return to the Array menu, press <Esc>. To check the progress of the expansion, you can use the expand status described below or select **Array Menu** from the System Menu. The status of the expansion displays in the list of arrays.

D.2.6.1 Viewing Expand Status

You can view the status of the expansion process while it is running. To view expand status:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press <Enter>. The Array menu displays.

3. Select **Expand Function** and press <Enter>
   The expand menu displays.

4. Select **View Expand Status** and press <Enter>
   The Expand Status screen displays.

5. Press <Esc> to return to the expand menu.

D.2.7 Changing an Array Name

You can change the name of an array. This does not affect the target ID or LUN values of the array. The EF2800 does not allow you to change an array name when a utility is running. To change an array name:

1. From the System Menu, select **Array Menu** and press <Enter>.
   The Select Array screen displays with a list of existing arrays.

2. Select the array you want and press <Enter>.
   The Array menu displays.

3. Select **Change Array Name** and press <Enter>
   The Enter New Name screen displays.

4. Enter the name you want to use and press <Enter>. You can use up to 20 characters. You can include any characters in the name, including spaces.

5. The system prompts you to confirm changes. Select **Yes** and press <Enter>.

D.2.8 Changing Array Ownership

You can change the ownership of any array between the SMs.

You might want to change ownership if you plan to replace or repair one SM. Changing ownership lets you continue using an array without interruption and makes the array visible on the SM you change it to. You can no longer see the array on the original SM.

NOTE: When you change the ownership of an array, the LUNs assigned to the array's partitions become invalid. After changing ownership, you must assign a new LUN to each array partition.

To change array ownership:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Switch Array Owner** and press <Enter>.
4. The system confirms that you want to make the change. Select **Yes** and press <Enter>.
5. Assign a new LUN to each array partition. See section D.3.5 on page 245.

D.2.9 Trusting an Array

You can use the Trust Array function to bring an array back online by re-synchronizing the time and date stamp and any other metadata on a bad disk. This makes the disk an active member of the array again. You might need to do this when:

- One or more disks of an array start up more slowly or were powered on after the rest of the disks in the array. This causes the date and time stamps to differ, which the EF2800 interprets as a problem with the "late" disks. In this case, the array will function normally after using Trust Array.
- An array is offline because a drive is failing, you have no data backup, and you want to try to recover the data from the array. In this case, the Trust Array function may work, but only as long as the failing drive continues to operate.

Before you can use this function, you must enable it in the Option Configuration menu.

Caution ! The Trust Array feature can cause unstable operation and data loss if used improperly. This feature is intended for disaster recovery.

To trust an array:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Option Configuration** and press <Enter>.
   The Option Configuration Menu displays.

3. Select **Enable Trust Array** and press <Enter>
   The Enable Trust Array screen displays.

4. Select **Enable** and press <Enter>.
   The option is only enabled until you use it. After you trust an array, the option reverts back to being disabled.

5. Press <Esc> twice to return to the System Menu.

6. Select **Array Menu** and press <Enter>.
   The Select Array screen displays with a list of existing arrays.

7. Select the array you want and press <Enter>. The Array menu displays. Select **Trust Array** and press <Enter>.

8. The system prompts you to confirm trust array. Select **Yes** and press <Enter>. The array will be back online.

NOTE: If the array does not come back online, it may be that too many members are offline or the array may have additional failures on the bus or enclosure that Trust Array cannot fix.

D.2.10 Deleting an Array

You can delete an array when you no longer need the array or you need the drives for another use.

Caution ! Deleting an array deletes all partitions and data contained in the array.

NOTE: You cannot delete an array while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the array.

To delete an array:

1. From the System Menu, select **Delete an Array** and press <Enter> The Select Array screen displays (Figure 113).

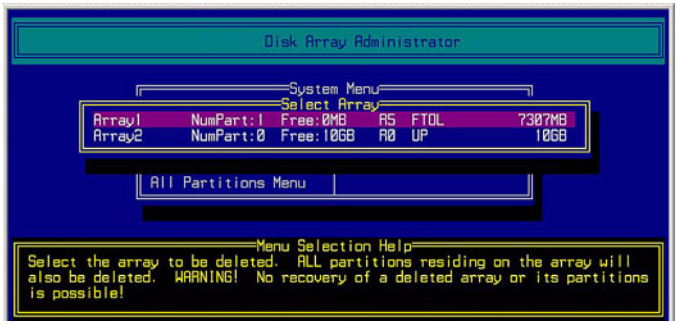

Disk Array Administrator
System Menu
Select Array
Array1 NumPart:1 Free:0MB R5 FTOL 7307MB
Array2 NumPart:0 Free:10GB R0 UP 10GB
All Partitions Menu
Menu Selection Help
Select the array to be deleted. ALL partitions residing on the array will also be deleted. WARNING! No recovery of a deleted array or its partitions is possible!

Figure 113. Select Array to Delete

2. Select the array you want to delete and press <Enter>.

3. The system asks you to confirm the deletion. Select **Yes** and press <Enter>.

D.3 Managing Partitions

The Disk Array Administrator software lets you manage partitions in a variety of ways. You can:

- View partition status information (see page 218)
- Add a partition (see page 222)
- Expand a partition (see page 243)
- Change a partition name (see page 244)
- Change a partition LUN (see page 245)
- Change a partition's read-ahead setting (see page 247)
- Control partition access (see page 250)
- Delete a partition (see page 257)

D.3.1 Understanding Partitions

The partitions discussed here are logical subdivisions of an array to which you can assign a LUN. You can add, expand, rename, change the LUN, and delete partitions using the RAID controller's software. This type of partition is *not* the same as a partition you create with your operating system or third party tools.

When you create an array, you can choose to make the array all one partition or set up the array for multiple partitions. Using multiple partitions lets you create one very large array making efficient use of your disk drives. For example, you could create one very large RAID 5 array and assign one dedicated spare to the array. This minimizes the amount of disk space allocated to parity and spares compared to the space required if you created five or six smaller RAID 5 arrays.

Once you set up an array for multiple partitions, you must create each partition by setting the partition size and assigning the partition a LUN. You can also give each partition a name. We recommend assigning names that indicate how the partition will be used. For example, if the first partition will be used to store your customer database, give it a name like: cust database.

When you first create an array set up for multiple partitions, all of the space on the array is designated as free space (Figure 114).

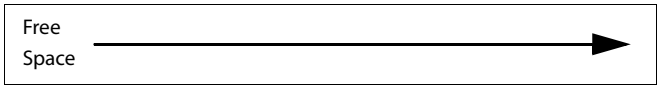


Figure 114. Array set up for multiple partitions before creating partitions

When you create a partition, you set how large you want the partition to be in MB (Figure 115).

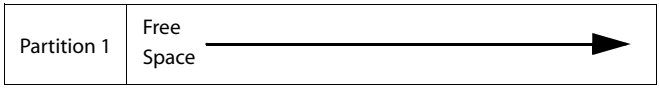


Figure 115. Array after creating one partition

The Disk Array Administrator assigns each partition a unique serial number and sequence number. It assigns sequence numbers in the order the partitions are created, so the first partition on an array is number 1, the second is 2, and so on. Once you create one or more partitions on an array, you can create additional partitions in the remaining free space or you can expand a partition with some limitations.

You can only expand a partition into contiguous, following, free space. In Figure 115, you can expand partition 1 or you can create additional partitions in the free space.

After you partition all of the free space, you can expand the size of a partition only by deleting a partition that follows (has a higher number than) the one you want to expand. In Figure 116, you can delete partition 3 and then expand partition 2 to use some or all of partition 3's space.

Figure 116. Array after creating five partitions

Caution ! If you delete a partition, you also delete all data stored in the partition. Be sure that you back up all data before deleting a partition.

When you expand an array, you add free space at the end of the array (Figure 117). For more information about expanding an array, see section D.2.6 page 228.

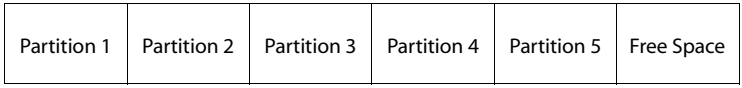


Figure 117. Array with five partitions after expanding the array

After expanding an array, you can either add a partition or expand the last partition to use the new free space. You can also delete one or more partitions and expand a partition into the space.

D.3.2 Viewing Partition Status Information

You can perform three functions related to partition status information:

- View partition status (see page 237)
- View partition statistics (see page 239)
- Reset partition statistics (see page 241)

D.3.2.1 Viewing Partition Status

You can view the status of a partition, including the following information:

- Array state: Online, Offline, Critical, or Fault-tolerant.
- Array type: RAID level (0, 3, 4, 5, 50, Volume, or Mirrored). The term “mirrored” is used for both RAID 1 and RAID 10 arrays.
- Array drives: Number of drives in the array when fault-tolerant. For example, if a three-drive RAID 5 array loses one drive, the number will still display 3.
- Name: Name you give to the partition.
- Serial number: Unique number the EF2800 assigns to each partition.
- Target ID:LUN: Target ID and LUN presented to the host system.
- Partition size: Size of the partition (expressed in MB).
- Percentage of total array: The percentage of the total array that this partition represents.

- Write-back caching: Status of the write-back cache (enabled or disabled) for this array.
- InfoShield Type: Type of InfoShield set up on the partition. See section D.3.8 on page 250.

To view the status of a partition:

1. Bring up the Partition menu.

   From the Array menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The partition menu displays (Figure 118).

   From the All Partitions Menu:

   - From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 118).

Figure 118. Partition Menu

2. Select **Partition Status** and press <Enter>. The status screen displays showing the status of the partition you selected (Figure 119).

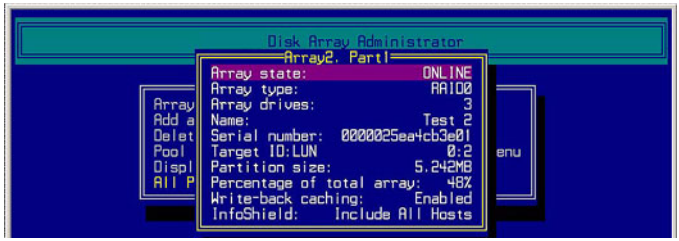


Figure 119. Partition Status Screen

3. Press <Esc> to return to the Partition menu.

D.3.2.2 Viewing Partition Statistics

You can view the current partition statistics. The following statistics are available:

- Read: Total number of host read requests directed to the partition
- Write: Total number of host write requests directed to the partition
- SecRd: Total number of sectors read from the partition
- SecWt: Total number of sectors written to the partition
- Queue Depth: Current number of commands from the host that are queued up
- I/O Size: Last host I/O block size request in 512-byte sectors

Similar statistics are also available on an aggregate basis for all partition LUNs. For more information, see section E.7, "Displaying Overall Statistics" on page 272.

To view the partition statistics:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.

- Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
- Select the partition you want and press <Enter>. The Partition menu displays (Figure 120).

From the All Partition Menu:

- From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
- Select the partition you want and press <Enter>. The partition menu displays (Figure 120).

Figure 120. Partition Menu

2. Select **Partition Statistics** and press <Enter>. The statistics menu displays (Figure 121).

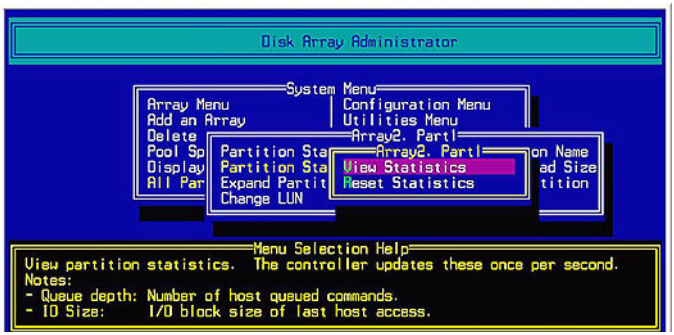


Figure 121. Partition Statistics Menu

3. Select **View Statistics** and press <Enter>. The statistics screen displays showing the statistics of the partition you selected (Figure 122).

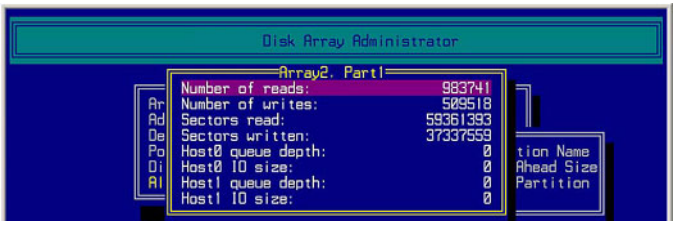


Figure 122. Partition Statistics Screen

4. Press <Esc> to return to the statistics menu.

D.3.2.3 Resetting Partition Statistics

You can reset the following partition statistics to zero:

- Read
- Write
- SecRd
- SecWt
- I/O Size

NOTE: Resetting statistics here also resets the statistics for this partition that are included in the aggregate statistics. See section E.7, "Displaying Overall Statistics" on page 272.

You may want to reset the statistics if you are monitoring performance or doing benchmark testing. You may also want to reset statistics when you change how you are using the partition.

NOTE: You cannot reset the queue depth value. It always reflects the current I/O queue depth.

To reset partition statistics:

1. Bring up the Partition menu.

   From the Array Menu:

- From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
- Select the array you want and press <Enter>. The array menu displays.
- Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
- Select the partition you want and press <Enter>. The Partition menu displays (Figure 123).

From the All Partition Menu:

- From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
- Select the partition you want and press <Enter>. The partition menu displays (Figure 123).

Figure 123. Partition Menu

2. Select **Partition Statistics** and press <Enter>. The statistics menu displays (Figure 124).

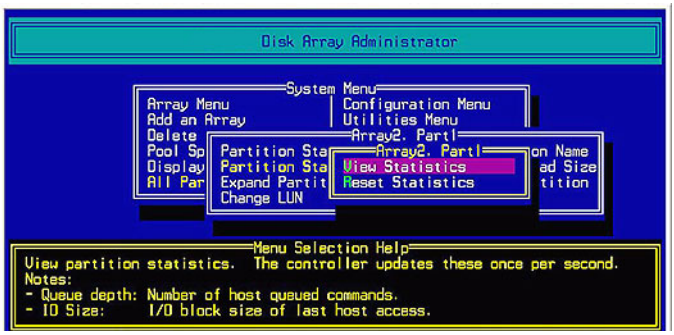


Figure 124. Partition Statistics Menu

3. Select **Reset Statistics** and press <Enter>.

4. The system confirms that you want to make the change. Select **Yes** and press <Enter>.

The system confirms that the statistics have been cleared and returns to the statistics menu.

D.3.3 Expanding a Partition

You can expand an existing partition, with some limitations. You can only expand a partition into contiguous, following, free space. For more information about partitions, see section D.3.1 on page 235.

To expand a partition:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 125).

   From the All Partition Menu:

   - From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
   - Select the partition you want and press <Enter>. The partition menu displays (Figure 125).

Figure 125. Partition Menu

2. Select **Expand Partition** and press <Enter>. The Expand Partition screen displays.

3. Enter the size you want to make the partition and press <Enter>. You can only expand a partition into contiguous free space that follows the partition. For more information, see section D.3.1 on page 235.

4. The system prompts you to confirm changes. Select **Yes** and press <Enter>.

D.3.4 Changing a Partition Name

You can change the name of a partition. This does not affect the target ID or LUN values of the partition. The EF2800 does not allow you to change a partition name when a utility is running.

To change a partition name:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.

- Select the partition you want and press <Enter>. The Partition menu displays (Figure 126).

From the All Partition Menu:

- From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
- Select the partition you want and press <Enter>. The partition menu displays (Figure 126).

Figure 126. Partition Menu

2. Select **Change Partition Name** and press <Enter>. The Enter New Name screen displays.

3. Enter the name you want to use and press <Enter>. You can use up to 20 characters. You can include any characters in the name, including spaces.

4. The system prompts you to confirm changes. Select **Yes** and press <Enter>.

D.3.5 Changing a Partition LUN

You can change the LUN assigned to a partition, as it appears under the EF2800's target ID from the host system's point of view. The change takes place immediately, however, you may need to restart the host system to see the partition at the new LUN.

NOTE: You cannot change the partition's LUN to one that is already in use. If you want to use a LUN that is already in use, you must first reassign the LUN in use.

For more information about LUNs and your EF2800, see section H.4, "Understanding LUNs and Viewing LUN Information" on page 305.

To change a partition LUN:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 127).

   From the All Partition Menu:

   - From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
   - Select the partition you want and press <Enter>. The partition menu displays (Figure 127).

Figure 127. Partition Menu

2. Select **Change LUN** and press <Enter>. The New LUN screen displays.

3. Enter the LUN you want to use and press <Enter>.

4. The system prompts you to confirm changes. Select **Yes** and press <Enter>.

D.3.6 Changing the Read-Ahead Cache Size

You can change the read-ahead cache setting for each partition. This setting controls how much data the EF2800 reads ahead and stores in its cache memory during sequential reads.

If you want to change this size, you should be prepared to monitor the system performance using the array statistics and adjust the size until you find the optimal size for your application.

The default setting is one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the array (default is 64 KB). The Storage Managers treat volumes and mirrored arrays (RAID 1) internally as if they have a stripe size of 64 KB, even though they are not striped.

If you specify a read-ahead cache size, that amount of data is read first, and the same amount is read for all read-ahead accesses.

Read-ahead is triggered by two back-to-back accesses to consecutive logical block address (LBA) ranges. Read-head can be forward (that is, increasing LBAs) or reverse (that is, decreasing LBAs).

Setting the read-ahead size to 0 turns off read-ahead cache. This is useful if the host is triggering read-ahead for what are random accesses. This can happen if the host breaks up the random I/O into two smaller reads, triggering read-ahead. You can use the partition statistics read histogram to determine what size accesses the host is doing.

Setting the read-ahead size to a very large size (say four to five stripes worth) can help improve the performance of multiple (three or more) sequential read streams, in some cases improving performance by three times. This would be useful for providing multiple video streams, for example.

To change the read-ahead size:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.

- Select the array you want and press <Enter>. The array menu displays.
- Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
- Select the partition you want and press <Enter>. The Partition menu displays (Figure 128).

From the All Partition Menu:

- From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
- Select the partition you want and press <Enter>. The partition menu displays (Figure 128).

Figure 128. Partition Menu

2. Select **Change Cache Params** and press <Enter>. Change Cache Params screen displays.
3. Select **Read-Ahead Size** and press <Enter>**.** The Read-Ahead Size screen displays (Figure 129).

Figure 129. Select Read-Ahead Size Screen

4. Select the amount of data you want the Storage Manager to read ahead for this partition and press <Enter>.

D.3.7 Enabling or Disabling Write-back Cache

You can enable or disable the write-back cache for a partition. By default, partition write- back cache is enabled. For most applications, this is the best setting.

NOTE: This feature is intended for advanced users only. You may hinder your system's performance if used incorrectly.

If you are writing large chunks of sequential data (as would be done in video editing, telemetry acquisition, or data logging), you might want to experiment with disabling the write-back cache. You may see large performance gains if you are writing data under the following circumstances:

- Sequential writes
- Large I/Os in relation to the stripe size
- Deep queue depth

If you are doing any type of random access to this partition, leave the write-back cache enabled.

To enable or disable write-back cache:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 130).

From the All Partition Menu:

- From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
- Select the partition you want and press <Enter>. The partition menu displays (Figure 130).

Figure 130. Partition Menu

2. Select **Change Cache Params** and press <Enter>. Change Cache Params screen displays.

3. Select **Write-back Cache** and press <Enter>. The Write-back Cache screen displays. The current option has an * next to it.

4. Select the option you want for this partition and press <Enter>.

D.3.8 Controlling Partition Access

The EF2800's InfoShield capability lets you specify which hosts can access each partition. This gives you complete control of array access based on your specific needs.

Before you set up InfoShield, you should know the World Wide Name (WWN) for each host that you want to set up. Your SAN administrator should know the WWNs for your network. You can display a list of the last 16 WWNs that the EF2800 is aware of on the SAN, and you can give each WWN a nickname of your own. This makes working with the InfoShield feature faster and easier.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 16 specific hosts or all hosts for each partition LUN.

Figure 131 shows an example of how you can use InfoShield. Array A has two partitions. Partition 1 has an include list that contains only Accounting, so only the Accounting server can access partition 1. Array B, partition 3 has an exclude list that contains only the Web server, so all hosts *except* the Web server can access the partition. Array C uses the default setting, Include All Hosts, which permits all hosts to access the array.

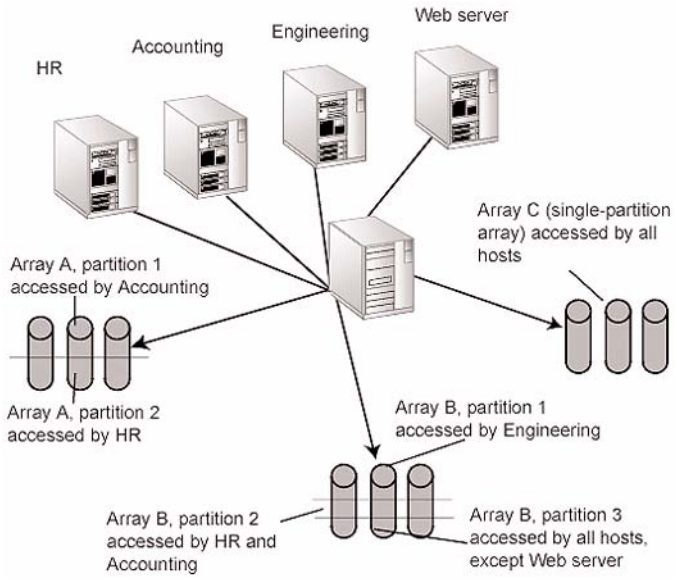

HR
Accounting
Engineering
Web server
Array C (single-partition array) accessed by all hosts
Array A, partition 1 accessed by Accounting
Array A, partition 2 accessed by HR
Array B, partition 1 accessed by Engineering
Array B, partition 2 accessed by HR and Accounting
Array B, partition 3 accessed by all hosts, except Web server

Figure 131. InfoShield Example

D.3.8.1 Viewing Known WWNs

You can view a list of 16 host WWNs that the EF2800 is aware of on your SAN. The EF2800 will be aware of any host that was started since the EF2800 was last restarted. Typically, hosts scan for devices during their start process. When this happens, the EF2800 saves the WWN information for the host and retains the information even after you restart the EF2800. The list includes the last 16 hosts that started or that you named.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, and then viewing the WWN list. The host that scanned for devices most recently is first on the list. You can then give the hosts nicknames you recognize, for example

you can use the computer name that has already been assigned to each host, to make InfoShield easier to manage.

To view known WWNs:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays (Figure 132).

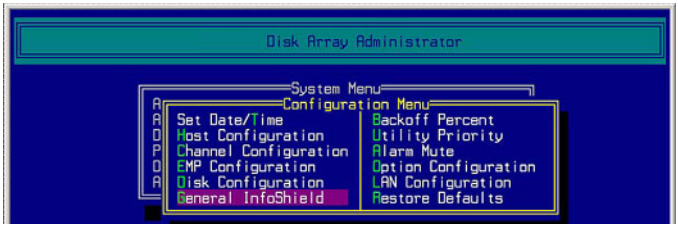


Figure 132. Configuration Menu

2. Select **General InfoShield** and press <Enter>. The General InfoShield screen displays.

3. Select **Display Host List** and press <Enter>.

   The Display Host List screen displays showing the last 16 WWNs known to the EF2800 (Figure 133). The WWNs are listed according to when they scanned for devices. The host that scanned for devices most recently is listed first.

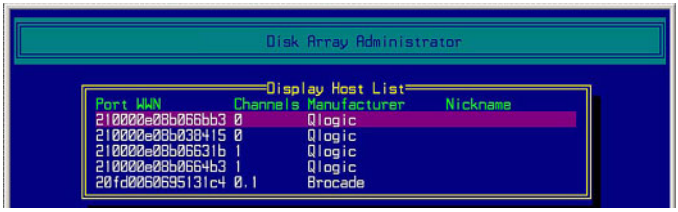


Figure 133. Display Host List Screen

NOTE: A host's WWN is placed at the top of the known hosts list whenever the host performs a device discovery or bus scanning type of operation.

4. Press <Esc> to return to the previous menu.

D.3.8.2 Creating Nicknames for Host WWNs

You can give the hosts on your SAN nicknames that you can easily recognize to make InfoShield easier to manage. For example, you can use the computer name that has already been assigned to each host.

You can determine which WWN is for which host by starting one host at a time or scanning for devices from a host, and then viewing the WWN list. The host that scanned for devices most recently is first on the list.

You can name up to 63 hosts, but you can only view the last 16 hosts that started or that you named. The list of 16 changes as you name hosts or as hosts restart. The nicknames are stored on the SMs, so if you change SMs, you have to rename the hosts.

To create or change nicknames for WWNs:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **General InfoShield** and press <Enter>. The General InfoShield screen displays.
3. Select **Add or Name Host** and press <Enter>. The Add or Name Host screen displays the last 16 known WWNs and host nicknames that you have set up (Figure 134). If the SM is not aware of any WWNs, the list is empty and the system asks you to enter a host WWN.

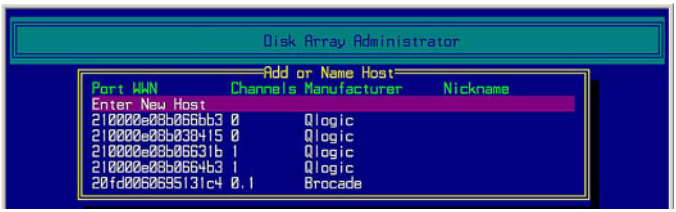


Figure 134. Add/Name Host List

4. Select **Enter New Host** to enter a nickname for a new host or select the WWN you want to name and press <Enter>. The Enter Host Name screen displays.
5. Enter the nickname you want and press <Enter>. You can enter up to 16 characters. You can use any combination of characters and spaces.

D.3.8.3 Configuring InfoShield

Once you set up host nicknames, you can easily set up your InfoShield. This is where you determine which hosts can access each partition LUN.

You set up InfoShield by either excluding or including hosts on a list for each partition LUN. The list can include or exclude up to 16 specific hosts or all hosts for each partition LUN.

The InfoShield information is stored as part of the array's metadata using the WWN for each host. If you install a new SM, the array partition's InfoShield will remain. The InfoShield will also remain if you change the partition's LUN.

NOTE: Changes to InfoShield take effect immediately, therefore, you should make changes that limit access to partitions when the partitions are not in use.

To set up InfoShield:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 135).

   From the All Partition Menu:

   - From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
   - Select the partition you want and press <Enter>. The partition menu displays (Figure 135).

Figure 135. Partition Menu

2. Select **InfoShield** and press <Enter>.

   The InfoShield menu displays and shows the current InfoShield type at the top (Figure 136). The default setting for each partition LUN is Include All Hosts. This results in all hosts being able to access all partitions. You can change the list type using the Change InfoShield Type option.

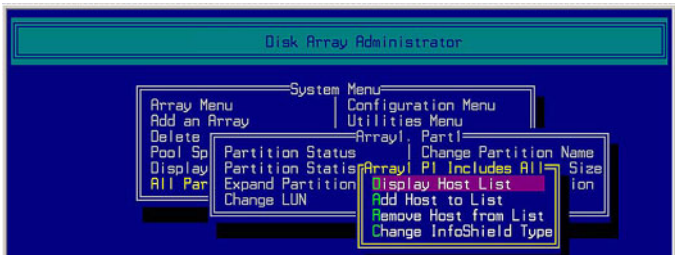


Figure 136. InfoShield Menu

3. Select the option you want and press <Enter>.

   - Display Host List: Displays a list of the hosts currently on the include or exclude list for the selected partition. This option only displays hosts if you have already used Add Host to List and added one or more WWNs to an include or exclude list.

   - Add Host to List: Displays the Enter Host WWN screen where you enter the WWN or name (alias) or select the host you want to add to the current list for the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or names, you can enter the WWN or nickname. Enter the WWN or nickname or select the host from the list and press <Enter>.

- Remove Host from List: Displays the Remove Host from List screen, which contains a list of the hosts currently on the include or exclude list for the selected partition. Select the WWN of the host you want to remove from the list and press <Enter>.
- Change InfoShield Type: Displays the Change InfoShield Type screen where you can change the InfoShield type to one of four options described below. Changing the InfoShield type does not add or remove any hosts in previously created lists.
- Include All Hosts: Permits all hosts on the network to access the selected array. This is the default InfoShield type. This results in all hosts being able to access all partitions. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.
- Include Listed Hosts: Lets you enter or select the WWNs of the specific hosts you want to be able to access the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or names, you can enter the WWN or nickname.
- Exclude All Hosts: Permits no hosts on the network to access the selected partition. If you have already created an include or exclude list, you can use this option to override the list. Your existing list is retained and you can display, add, or remove hosts from the list.
- Exclude Listed Hosts: Lets you enter or select the WWNs or names (aliases) of the specific hosts you do *not* want to be able to access the selected partition. The list of WWNs and nicknames that displays contains only the last 16 hosts that started or that you named. If you know other WWNs or nicknames, you can enter the WWN or nickname.

Whether you use an include or exclude list depends on your needs. You may want to determine which list would be shorter and create the shorter list.

4. If you have changed the InfoShield, the system will prompt you to confirm changes. Select **Yes** and press <Enter> to make the changes. The system confirms that the changes are made.

5. Press <Esc> to return to the InfoShield screen.

D.3.8.4 Changing All Partitions to Include All Hosts

You can change all partitions to include all hosts from the General InfoShield menu. This lets you quickly change the InfoShield setting for all partitions at once to permit all hosts to see all partitions, overriding the existing setting for each partition. However, the EF2800 retains all existing include and exclude lists.

If you use this option and later need to change back to your previous InfoShield settings, you must do so by changing the setting for each partition individually. See section D.3.8.3 on page 254.

To change all partitions to include all hosts:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **General InfoShield** and press <Enter>.
   The General InfoShield screen displays.

3. Select **Include All Hosts** and press <Enter>.
   The system confirms that the changes are made.

4. Press <Esc> to return to the General InfoShield screen.

D.3.9 Deleting a Partition

You can delete a partition when you no longer need it and you want to use the space for another purpose.

Caution ! Deleting a partition deletes all data contained in the partition.

NOTE: You cannot delete a partition while any utility (Initialize, Verify, Expand, or Reconstruct) is running on the array. You must stop the utility, if allowed, or let it finish before you can delete the partition.

To delete a partition:

1. Bring up the Partition menu.

   From the Array Menu:

   - From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
   - Select the array you want and press <Enter>. The array menu displays.
   - Select **Partition Menu** and press <Enter>. The Select Partition screen displays with a list of existing partitions for the current array.
   - Select the partition you want and press <Enter>. The Partition menu displays (Figure 137).

   From the All Partition Menu:

   - From the System Menu, select **All Partitions Menu** and press <Enter>. The Select Partition or Free Area screen displays with a list of existing partitions and free space.
   - Select the partition you want and press <Enter>. The partition menu displays (Figure 137).

Figure 137. Partition Menu

2. Select **Delete This Partition** and press <Enter>. The system asks you to confirm the deletion. Select **Yes** and press <Enter>. The Delete Partition option is also available from the Array Menu.

E

Monitoring System Status

E.1 Introduction

Using the Disk Array Administrator, you can monitor your system. You should monitor your system regularly to ensure that the EF2800, disks, and arrays are working properly. The EF2800 and Disk Array Administrator software let you monitor the status several ways:

- EF2800 LEDs (see Figure 138)
- Event log (see page 260)
- Module status screens (see page 265)
- Hardware and configuration information screens (see page 266)
- Complete event, hardware, and configuration capture (see page 270)
- Drive error statistics (see page 271)
- Overall Statistics screen (see page 272)
- Array status screen (see page 218)
- Disk status screen (see page 220)

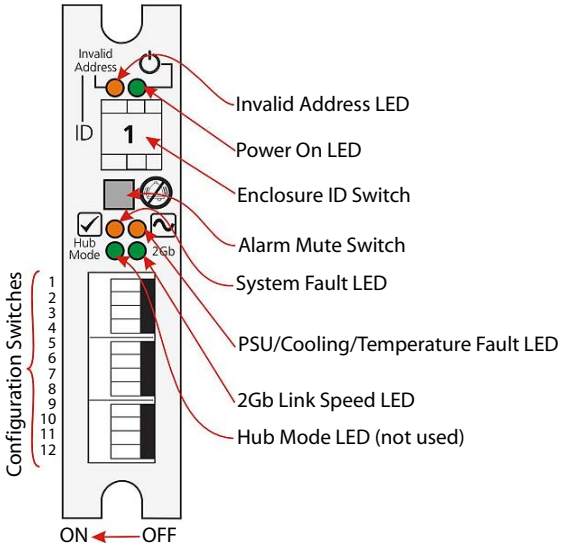


Figure 138. Ops Panel

E.2 Displaying the Event Log

The SM's event log contains important information about the status of the EF2800, disks, and arrays. You should check it regularly for each SM to monitor the status of your system.

Below is a list of some of the key warning and failure events included in the event log during operation:

- Disk detected error
- Disk channel error
- Battery failure
- Drive down
- Power up
- Array critical
- Array offline
- Temperature warning

- Temperature failure (this leads to a shutdown which is also logged)
- Voltage warning
- Voltage failure (this leads to a shutdown which is also logged)

The event log stores the most recent 400 events. Events have a time stamp next to them with one-second granularity.

NOTE: If you are having a problem with the EF2800 or an array, check the event log before calling technical support. Event messages may let you resolve the problem without calling.

You can view the event information three ways:

- Most recent event
- One event at a time, most recent event first
- Full screen of events at a time

You can also capture the event log to a file. See E.2.4 on page 264.

E.2.1 Viewing the Most Recent Event

When you first access the Disk Array Administrator software, any events that have occurred display. Informational events scroll by automatically. Warning events (yellow text on a black background) and error events (white text on a red background) display until you press <Enter> or <Esc**>**. Once all the events display, the initial screen displays. The initial screen alternates between displaying the date, time, and temperature and the model number of your hardware.

You can bypass all events by pressing <Tab>.

E.2.2 Viewing One Event at a Time

You can view an SM's events one at a time. The events display in reverse chronological order, that is, the most recent event is first.

If an event displays several parameters, you can see all of them when you view the log one event at a time. When you view a whole screen of events, some parameters may be truncated.

To view one event at a time:

1. From the System Menu, select **Event Log Menu** and press <Enter> The Event Log Menu displays (Figure 139).

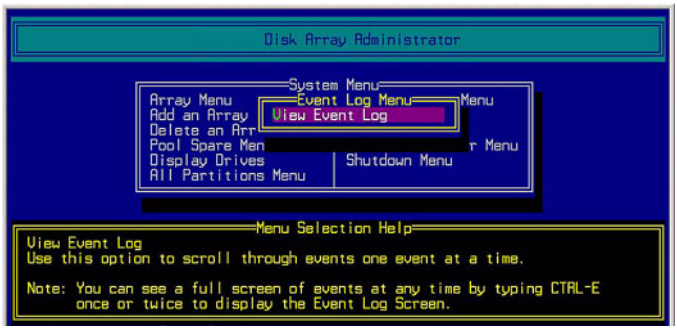

Disk Array Administrator
System Menu
Array Menu
Add an Array
Delete an Arr
Pool Spare Men
Display Drives
All Partitions Menu
Event Log Menu
View Event Log
Menu
r Menu
Shutdown Menu
Menu Selection Help
View Event Log
Use this option to scroll through events one event at a time.
Note: You can see a full screen of events at any time by typing CTRL-E
once or twice to display the Event Log Screen.

Figure 139. Event Log Menu

2. Select **View Event Log** and press <Enter>. The event log screen displays the last event that occurred (Figure 140).

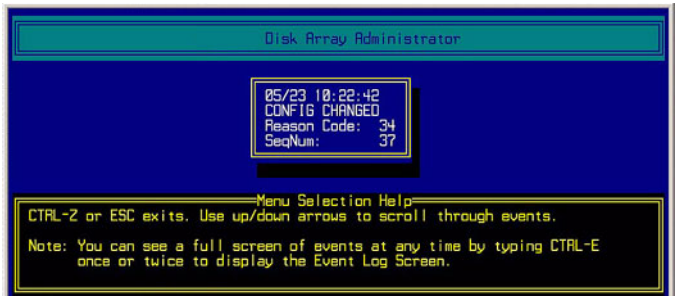

Disk Array Administrator
05/23 10:22:42
CONFIG CHANGED
Reason Code: 34
SeqNum: 37
Menu Selection Help
CTRL-Z or ESC exits. Use up/down arrows to scroll through events.
Note: You can see a full screen of events at any time by typing CTRL-E
once or twice to display the Event Log Screen.

Figure 140. Event Log Screen

3. Press ↑ to see the previous event. You can continue to view earlier events by pressing ↑.

4. Press <Esc> to return to the Event Log Menu.

E.2.3 Viewing a Whole Screen of Events

You can also view a SM's events from the log file a whole screen at a time. This lets you quickly review all recent events. The events display in chronological order, that is, the most recent event is last.

When you view a whole screen of events, some parameters may be truncated. If an event displays several parameters, you can see all of them when you view the log one event at a time.

To view a whole screen of events:

1. From anywhere in the Disk Array Administrator software, press <Ctrl>-<E> until the Event Log screen displays. The first screen of events from the event log displays (Figure 141).

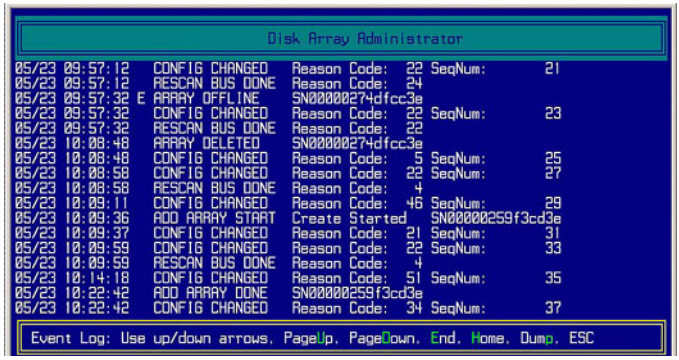

Disk Array Administrator
05/23 09:57:12 CONFIG CHANGED Reason Code: 22 SeqNum: 21
05/23 09:57:12 RESCAN BUS DONE Reason Code: 24
05/23 09:57:32 E ARRAY OFFLINE SN00000274dfcc3e
05/23 09:57:32 CONFIG CHANGED Reason Code: 22 SeqNum: 23
05/23 09:57:32 RESCAN BUS DONE Reason Code: 22
05/23 10:08:48 ARRAY DELETED SN00000274dfcc3e
05/23 10:08:48 CONFIG CHANGED Reason Code: 5 SeqNum: 25
05/23 10:08:58 CONFIG CHANGED Reason Code: 22 SeqNum: 27
05/23 10:08:58 RESCAN BUS DONE Reason Code: 4
05/23 10:09:11 CONFIG CHANGED Reason Code: 46 SeqNum: 29
05/23 10:09:36 ADD ARRAY START Create Started SN00000259f3cd3e
05/23 10:09:37 CONFIG CHANGED Reason Code: 21 SeqNum: 31
05/23 10:09:59 CONFIG CHANGED Reason Code: 22 SeqNum: 33
05/23 10:09:59 RESCAN BUS DONE Reason Code: 4
05/23 10:14:18 CONFIG CHANGED Reason Code: 51 SeqNum: 35
05/23 10:22:42 ADD ARRAY DONE SN00000259f3cd3e
05/23 10:22:42 CONFIG CHANGED Reason Code: 34 SeqNum: 37
Event Log: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC

Figure 141. Event Log

2. Press <U> to page up or <D> to page down in the log or use the other keys as listed at the bottom of the screen to navigate within the event log.

3. Keep pressing <Ctrl>-<E> to page through the other information screens and return to the menu.

E.2.4 Capturing the Event Log

You can also capture a SM's entire event log, which saves it to a file on your hard drive. This is useful if you want to print the log or attach it to an e-mail message.

The steps below use HyperTerminal as the terminal emulator software. If you use a different terminal emulator, your procedure may be different.

To capture the event log file:

1. With HyperTerminal up and running as your RS-232 interface terminal, press <Ctrl>-<E> until the event log displays.
2. From the Transfer menu in HyperTerminal, select **Capture Text**. The Capture Text window displays.
3. Enter the path and file name you want to use to store the log file contents. Save the file with a.txt file extension.
4. Click **Start**. Then press <P> on the keyboard to begin the transfer.
5. From the Transfer menu in HyperTerminal, select **Capture Text**, then select **Stop**.
6. To capture the event log for the other SM, repeat the above steps on the computer connected to the other SM.

E.3 Displaying Module Status Information

You can display status information about each of the modules in your EF2800.

- LRC I/O modules
- Power Supply/Cooling modules (two)

To display module status information:

1. From the System Menu, select **Other Controller Menu** and press <Enter>. The Other Controller Menu screen displays (Figure 142).

Figure 142. Other Controller Menu

2. Select the operation you want to perform.
3. Press <Esc> to return to the manage module menu.

E.4 Displaying Hardware and Configuration Information

You can display the EF2800's hardware and configuration information. This is where you can see what version of the firmware you have. Technical support personnel may request this information.

You can display the hardware and configuration information two ways:

- Hardware information only
- Hardware and configuration information

Figure 143 lists the configuration information that is available.

Figure 143. Configuration Information (per SM)

Group	Field	What displays	Field	What displays
HOST 0 HOST 1	Active Channel	Speed—1 Gb/s or 2 Gb/s as set in the Disk Array Administrator software.		
	Topology	Loop or Point-to-Point as set in the Disk Array Administrator software.		
	Node WWN	FC World Wide Name for node.		
	Port WWN	FC World Wide Name for port.		
	Loop ID	SOFT or a specific number as set in the Disk Array Administrator software.	Current Loop ID	Currently assigned value or Inactive if the FC link is not active.
	FC Addr	24-bit FC address or None if the FC link is not active.	AL_PA	Currently assigned value or None if the FC link is not active.
	CAPI LUN	NONE or specific number as set in the Disk Array Administrator software.		

Figure 143. Configuration Information (Continued)(per SM)

Group	Field	What displays	Field	What displays
DISK 0 DISK 1 DISK 2 DISK 3	Online or Offline Health	Status of disk channel based on whether a disk enclosure is connected and can be: Good, Down (not online) Probation (had errors but now has a time limit before it gets back to good status or failure for some reason), Degraded (had some errors but link has not failed), Failed (excessive errors causing link to fail), Unknown (status cannot be determined).	Speed	1 or 2 Gbit/sec as set in Disk Array Administrator software.
	Loop map	Lists disk drive loop IDs in the order discovered on the loop.		
DATAMGR	Operating Mode	Always Active-Active.		
	A-A Status	Current status of the EF2800 (Not Failed Over or Failed Over).		
	A-A Version	Version of the active-active software.		
	Backoff	Percentage set in Disk Array Administrator software (1% is the default and recommended value).	Utility Pri	HIGH, MED, or LOW utility priority as set in Disk Array Administrator software.
	Alarm Mute	ON or OFF as set in Disk Array Administrator software.	Battery	ENABLED or DISABLED as set in Disk Array Administrator software.
	Cache Lock	ON or OFF as set in Disk Array Administrator software.	Dyn. Spare	ON or OFF as set in Disk Array Administrator software.

Figure 143. Configuration Information (Continued)(per SM)

Group	Field	What displays	Field	What displays
DISK	WBCache	ENABLED, DISABLED, or NO MODIFY as set in Disk Array Administrator software.	SMART	ENABLED, DISABLED, or NO MODIFY as set in Disk Array Administrator software.
CAPI	Version	Version of the Configuration Application Programming Interface.		
FC LIB	Version	Version of the FC software.		
EMP	Poll Rate	Number of seconds as set in the Disk Array Administrator software.	Temperature	ON or OFF as set in Disk Array Administrator software.
	Slot flags	ON or OFF as set in Disk Array Administrator software.	Global Flags	ON or OFF as set in Disk Array Administrator software.

To display hardware information only:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays (Figure 144).

Figure 144. Utilities Menu

2. Select **Hardware Information** and press <Enter>. The Hardware Information screen displays (Figure 145).

Figure 145. Hardware Information Screen

3. Press <Esc> to return to the Utilities Menu.

To display hardware and configuration information:

1. From anywhere in the Disk Array Administrator software, press <Ctrl><->E until the HW Info screen displays.

   The HW Info screen displays. Press <U> to page up or <D> to page down in the screen or use the other keys as listed at the bottom of the screen to navigate within the HW Info screen (Figure 146).

Disk Array Administrator
Firmware revision: D100
Baselevel: D100R01
Board revision: B
CPLD revision: 03
Memory Controller: F100R27
Loader revision: 9.004
Serial Number: 0050CC000002
Product ID: EF2800
Controller ID: A Primary
Data Memory: 512 MB
Buffer SDRAM ECC: On
PCIX Clock (CMOS): 66 MHz
DDR Clock (CMOS): 80 MHz
SC CPU Frequency: 700 MHz
Host 0 SFP: Installed
Host 0 RX Signal: OK
Host 0 TX Signal: OK
LAN Connection: Installed
LAN Hardware Status: Up
LAN Firmware Revision: v3.4
LAN Firmware Version: P342R01x24
LAN Firmware Build Time: May 5 2004 15:52
LAN Loader Version: 7.013
Ethernet Physical Address: 00-50-cc-00-00-02
Current IP Address: 010.000.035.211
Pending IP Address: 010.000.035.211
Current IP Subnet Mask: 255.255.255.000
Pending IP Subnet Mask: 255.255.255.000
IP Gateway: 010.000.035.001
SNMP Trap Host: 000.000.000.000
FTP Firmware Upload: Enabled
Telnet: Enabled
HTTP: Enabled
SNMP: Enabled
HW Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC

Figure 146. Hardware Information Screen

2. Press <Ctrl>-<E> again.

   The CFG Info screen displays. Press <U> to page up or <D> to page down in the screen or use the other keys as listed at the bottom of the screen to navigate within the CFG screen.

Disk Array Administrator
HOST 0 External Link UP Loop map (2 IDs): 0 - 1
Private Loop, 2Gb/s
Node WWN = 10000050CC000002
Port WWN = 20000050CC000002
AL_PA = EF, Loop ID = 0 (SOFT), CAPI LUN = 0
HOST 1 External Link UP Loop map (2 IDs): 0 - 1
Private Loop, 2Gb/s
Node WWN = 10000050CC000002
Port WWN = 20010050CC000002
AL_PA = EF, Loop ID = 0 (SOFT), CAPI LUN = 0
CHAN 0 External Link UP Health = Good 2Gb/s
Loop map (18 IDs): 125 - 8 - 11 - 10 - 9 - 14 - 12 - 13 - 15
: - 0 - 3 - 2 - 1 - 6 - 4 - 5 - 7 - 124
CHAN 1 External Link UP Health = Good 2Gb/s
Loop map (18 IDs): 125 - 124 - 13 - 15 - 14 - 12 - 8 - 11 - 9
CFG Info: Use up/down arrows, PageUp, PageDown, End, Home, Dump, ESC

Figure 147. CFG Information Screen

3. Press <Ctrl>-<E> to display the next screen of configuration information or <Esc> to return to where you started from.

E.5 Capturing Event Log, Hardware, and Configuration Information

You can capture and save the following information to a file on your hard drive:

- Entire event log
- All hardware information
- All configuration information
- All debug information that is turned on.

This is useful if you want to print all of this information or attach it to an e-mail message.

The steps below use HyperTerminal as the terminal emulator software. If you use a different terminal emulator, your procedure may be different.

To capture the event log, hardware, and configuration information:

1. With HyperTerminal up and running as your RS-232 interface terminal, from the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.

2. From the Transfer menu in HyperTerminal, select **Capture Text**. The Capture Text window displays.
3. Enter the path and file name you want to use to store the log file contents. Save the file with a.txt file extension.
4. Click **Start**.
5. Select **Dump Debug Info** and press <Enter>.
6. From the Transfer menu in HyperTerminal, select **Capture Text**, then select **Stop**.
7. To capture the same information for the other SM, repeat the above steps from the computer connected to the other SM.

E.6 Displaying Drive Errors and Resetting Error Statistics

You can display drive errors for a specific drive. You know a drive has errors when you see the letter E in the first column of the Display Drives screen.

To display drive errors:

1. From the System Menu, select **Display Drives** and press <Enter>. The Display Drives screen displays.
2. If a drive has an "E" next to it, select the drive and press <Enter> to display the error information.

   Some errors are primarily for information purposes to help you diagnose drive and enclosure problems. For more information about SMART errors, refer to the drive manufacturer's specifications. For more information about FC errors, refer to: www.t11.org, click **Drafts**, find the *FC-FS 1.6 T11/02-018v0 dpANS - Fibre Channel Framing and Signaling Interface* document, and go to section 21.

   To reset the error statistics, select **Reset drive error statistics** and press <Enter>.
3. Press <Esc> to return to the list of drives.

E.7 Displaying Overall Statistics

You can display two types of aggregate statistics for all partition LUNs:

- General statistics (Similar statistics are also available for individual partition LUNs. For more information, see section D.3.2.2, "Viewing Partition Statistics" on page 239.)
  - I/O operations per second (IOPS)
  - Bandwidth (in millions of bytes per second)
  - Number of read operations
  - Number of write operations
  - Total sectors (512 bytes) read
  - Total sectors written
  - Total current command queue depth across all LUNs
- Host read/write histogram that shows how many host reads and writes fell into a particular size range. The I/O ranges are based on powers of two:
  - 1 Sector
  - 2–3 Sectors
  - 4–7 Sectors
  - 8–15 Sectors
  - 16–31 Sectors
  - 32–63 Sectors
  - 64–127 Sectors
  - 128–255 Sectors
  - 256–511 Sectors
  - 512–1023 Sectors
  - 1024–2047 Sectors
  - 2048 (and larger) Sectors

Tip: This information may be helpful in interpreting performance based on individual system configuration such as HBA, driver configuration, SAN configuration, and host operating system configuration. The statistical information can be useful to profile applications and their usage of a partition, which could be used to

determine if additional arrays would increase performance and what type of RAID level is applicable to your needs. You may want to analyze the performance of the same application using different RAID levels to determine which level gives you the best performance. See Appendix B, "Array Basics" on page 185 for more details on RAID levels.

NOTE: The statistics are provided as general information for your use, however, they are not intended for benchmarking purposes.

To access the overall array statistics:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Overall Statistics** and press <Enter>. The Overall Statistics screen displays.
3. Select **View Statistics** and press <Enter>. The View Statistics screen displays.
4. Press <Esc> to return to the Overall Statistics screen.

To access the read/write histogram:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Overall Statistics** and press <Enter>. The Overall Statistics screen displays.
3. Select **View R/W Histogram** and press <Enter>. The View R/W Histogram screen displays.
4. Press <Esc> to return to the Overall Statistics screen.

E.7.1 Resetting Overall Statistics

You can also reset all of the overall statistics back to zero. You may want to reset the statistics if you are monitoring performance or doing benchmark testing.

NOTE: Resetting statistics here also resets the statistics for each individual partition. See section D.3.2.3 on page 241.

To reset overall statistics:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Overall Statistics** and press <Enter>. The Overall Statistics screen displays.
3. Select **Reset All Statistics** and press <Enter>.
4. The system prompts you to confirm changes. Select **Yes** and press <Enter>. The system confirms that the statistics have been cleared and returns to the Overall Statistics screen.

F

Managing Spares

Using the Disk Array Administrator, you can manage spares.

EF2800 RAID controllers automatically reconstruct redundant (fault-tolerant) arrays (RAID 3, RAID 4, RAID 5, RAID 50, and mirrored) if an array becomes critical and a properly sized spare drive is available. An array becomes critical when one or more member drives fails.

You can set up two types of spare drives:

- Dedicated: Available drive that is assigned to a specific array (see page 276).
- Pool: Available drive that is assigned to the pool, which can provide a spare for any failed drive in any redundant array. Pool spares are available to both SMs. If a drive in an array on either SM fails, the EF2800 Subsystem can use a pool spare to reconstruct the array (see page 280).

In addition, if you enable the Dynamic Spares option and a drive fails, you can replace the drive and the SM will rescan the bus, find the new disk drive, and automatically start reconstruction of the array (see page 278). The SM looks for a dedicated spare first. If it does not find a properly sized dedicated spare, it looks for a pool spare.

If a reconstruct does not start automatically, it means that no valid spares are available. To start a reconstruct, you must:

1. Replace the failed drive, if no other drive is available.
2. Add the new drive or another available drive as a dedicated spare to the array or as a pool spare.

   Remember that any pool spares added might be used by any critical array, not necessarily the array you want.

F.1 Managing Dedicated Spares

Dedicated spares are unused disk drives that you assign as a spare to a specific array. The disk must be as large as the smallest member of the array. You cannot use a dedicated spare drive as a member of an array or as a pool spare.

Although using a dedicated spare is the most secure way to provide spares for your arrays, it is also expensive to keep an idle drive assigned to each array. An alternative method is to assign one or more idle drives to the spare pool. See section F.3 on page 280.

F.1.1 Adding a Dedicated Spare

You assign dedicated spare drives to a specific array. If a member drive in the array fails, the EF2800 uses a dedicated spare drive to automatically reconstruct the array. You can add dedicated spare drives to mirrored (RAID 1 and RAID 10) and parity (RAID 3, RAID 4, RAID 5, and RAID 50) arrays when you create the array or afterward. You can assign up to four dedicated spare drives to an array. For more information about assigning spares when you create an array, see section D.1, "Creating Arrays" on page 205.

NOTE: You cannot add a spare that does not have enough capacity to replace the smallest member in the array.

To add a dedicated spare:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Add Spare** and press <Enter>**.** The list of drives screen displays listing the available drives.

NOTE: If a drive was a member of an array and was removed from the array, you cannot use it as a spare until you clear the drive's metadata. For more information, see section G.1.2, "Clearing Metadata from a Drive" on page 288.

To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.

4. Select the drive you want to add as a spare and press <Enter>. The system confirms the change.
5. Select **Yes** and press <Enter>.

F.1.2 Deleting a Dedicated Spare

You can delete a dedicated spare drive from an array at any time.

To delete a dedicated spare:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Delete Spare** and press <Enter>.
4. Select the spare drive you want to delete and press <Enter>.
5. The system confirms the deletion. Select **Yes** and press <Enter> to delete the spare. The drive is now available for use in an array or as a spare.

F.2 Enabling Dynamic Spares

The Dynamic Spares option lets you use all of your disk drives in redundant arrays, without assigning one as a spare. For example, if you enable Dynamic Spares and a drive fails, you can replace the drive and the SM will rescan the bus, find the new disk drive, and automatically start reconstruction of the array. The SM automatically finds the new drive and reconstructs the array.

With Dynamic Spares enabled, if you have spares or available drives, the SM first looks for a dedicated or spare pool drive for the reconstruction. If none is found, it uses an available drive, which the SM automatically assigns as a spare and starts reconstruction.

You must make sure that the new or available drive has enough capacity to replace the smallest member in the array and does not contain metadata (see section G.1.2, "Clearing Metadata from a Drive" on page 288).

A change to this setting on either SM is automatically updated on the other SM.

NOTE: Performance in systems *without* an enclosure management processor (EMP) will decrease if an array becomes critical with this option enabled and there are no available drives to start reconstruction. To minimize the performance impact, increase the EF2800 rescan rate as described in the steps below.

To enable dynamic spares:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Option Configuration** and press <Enter>.
   The Option Configuration screen displays.

3. Select **Dynamic Spare Configuration** and press <Enter>.
   The Dynamic Spare Config screen displays. The current setting is marked with an * next to it.

Figure 148. Dynamic Spare Config Menu

4. Select **Enabled** and press <Enter>. The Rescan Rate screen displays.

5. Enter the rescan rate in minutes.

   This tells the SM how often it should look for an available drive by rescanning the bus. Rescanning the bus frequently can affect performance. If you have an EMP, the dynamic spare configuration will not rescan the bus. The EMP will detect the new drive and tell the SM to rescan; the rescan rate you set here will not affect the system.

6. The system confirms the change. Select **Yes** and press <Enter>.

F.3 Managing the Spare Pool

The spare pool lets you have one or more disk drives available for the reconstruction of redundant arrays (mirrored [RAID 1 and RAID 10] and parity [RAID 3, RAID 4, RAID 5, and RAID 50]). Once you assign a drive to the spare pool, it is not available for use as an array member or as a dedicated spare.

Pool spares are available to both SMs. If a drive in an array on either SM fails, the SM can use a pool spare to reconstruct the array.

If a pool spare is too small (smaller than an individual member in an array), the SM cannot use it.

F.3.1 Adding a Spare to the Spare Pool

You can add up to eight drives to the spare pool to reconstruct any critical array on the EF2800. After an array has started using a pool spare, other critical arrays are prevented from using it. For a pool spare to be used, it must be at least as large as the smallest drive in the array.

To add a pool spare:

1. From the System Menu, select **Pool Spare Menu** and press <Enter>. The Pool Spare Menu displays.
2. Select **Add Pool Spare** and press <Enter>. The Select Drives screen displays.

   To blink the selected drive, press <B>. The blink function is a toggle. Press <B> again to stop the blinking. You can also blink more than one drive by selecting each drive and pressing <B>.

   To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.
3. Select each spare drive you want to add and press <Enter>.

F.3.2 Deleting a Spare from the Spare Pool

You can delete a spare from the spare pool at any time.

To delete a spare from the spare pool:

1. From the System Menu, select **Pool Spare Menu** and press <Enter>. The Pool Spare Menu displays.
2. Select **Delete Pool Spare** and press <Enter>. The Delete Pool Spare screen displays listing the drives assigned to the spare pool.
3. Select the pool spare you want to delete and press <Enter>.

F.3.3 Displaying the Spare Pool

You can display a list of all of the pool spares.

To display the spare pool:

1. From the System Menu, select **Pool Spare Menu** and press <Enter>. The Pool Spare Menu displays.
2. Select **Display Pool Spares** and press <Enter>. The Display Pool Spare screen displays listing all disk drives assigned to the spare pool.
3. Press <Esc> to return to the Pool Spare Menu.

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G

Managing Disk Drives and Enclosures

Using the Disk Array Administrator, you can control a variety of functions related to disk drives and enclosure management processor (EMP) enclosures connected to your EF2800.

- For drives, you can:
  - Display drive information (see page 284)
  - Clear metadata from a drive (see page 288)
  - Enable/disable write-back cache (see page 288)
  - Display disk cache status (see page 290)
  - Enable/disable changes to SMART (see page 291)
  - Blink a drive LED (see page 292)
  - Take down a drive (see page 292)
  - Test a drive (see page 293)
- For EMP enclosures, you can:
  - Change the EMP LUN (see page 294)
  - Change additional EMP settings (see page 296)

G.1 Managing Disk Drives

The Disk Array Administrator software lets you control a variety of functions related to disk drives. You should also refer to your disk drive or enclosure documentation for information about related functions.

G.1.1 Displaying Drive Information

You can display three types of information about disk drives:

- A list of all drives connected to the EF2800
- The status of all drives in an array
- Errors on a specific drive and reset error statistics

G.1.1.1 Displaying All Drives

You can display a list of all connected drives. The information includes:

- Loop ID
- Size
- Vendor
- Model number (toggles with node WWN and serial number by pressing <T>)
- Node WWN (toggles with model number and serial number by pressing <T>)
- Serial number (toggles with node WWN and model number by pressing <T>)
- Drive firmware revision

If any of the drives are members of an array, the following information may also display:

- Utility running: such as Expand, Verify
- Array number: The array's sequential position in the EF2800's array list
- Member number: The drive's sequential position in the array

Drives that are not members of any array are listed as Available. Drives that contain leftover metadata from a previous array are listed as Leftover. This situation can arise if drives are removed and reinserted or the drives failed temporarily and are not operating again. To clear leftover metadata, use the Clear Metadata function. See section G.1.2, "Clearing Metadata from a Drive" on page 288.

You can also perform two functions from the list of drives:

- View drive errors
- Blink the selected drive

To display all drives:

1. From the System Menu, select **Display Drives** and press <Enter>. The Display Drives screen displays (Figure 149).

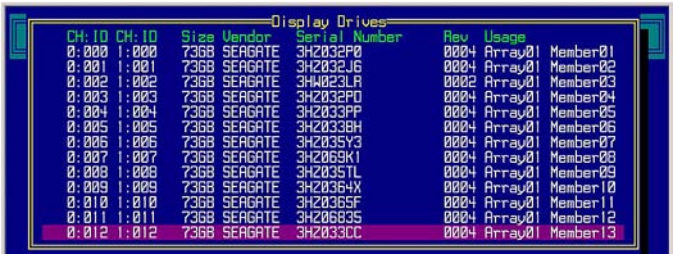
Display Drives
CH:ID CH:ID Size Vendor Serial Number Rev Usage
0:000 1:000 73GB SEAGATE 3HZ032P0 0004 Array01 Member01
0:001 1:001 73GB SEAGATE 3HZ032J6 0004 Array01 Member02
0:002 1:002 73GB SEAGATE 3HW023LA 0002 Array01 Member03
0:003 1:003 73GB SEAGATE 3HZ032PD 0004 Array01 Member04
0:004 1:004 73GB SEAGATE 3HZ033PP 0004 Array01 Member05
0:005 1:005 73GB SEAGATE 3HZ0338H 0004 Array01 Member06
0:006 1:006 73GB SEAGATE 3HZ035Y3 0004 Array01 Member07
0:007 1:007 73GB SEAGATE 3HZ069K1 0004 Array01 Member08
0:008 1:008 73GB SEAGATE 3HZ035TL 0004 Array01 Member09
0:009 1:009 73GB SEAGATE 3HZ0364X 0004 Array01 Member10
0:010 1:010 73GB SEAGATE 3HZ0365F 0004 Array01 Member11
0:011 1:011 73GB SEAGATE 3HZ06835 0004 Array01 Member12
0:012 1:012 73GB SEAGATE 3HZ033CC 0004 Array01 Member13

Figure 149. Display Drives Screen

If a drive has an E in the first column, select the drive and press <Enter> to display the error.

To reset the error statistics, select **Reset drive error statistics** and press <Enter>.

To blink the selected drive, press <B>. The blink function is a toggle. Press <B> again to stop the blinking. You can also blink more than one drive by selecting each drive and pressing <B>.

To toggle the display between the drive model number, serial number, and the node and WWN, press <T>.

2. Press <Esc> to return to the System Menu.

G.1.1.2 Viewing Drive Status

You can view the status of the drives in an array, including the following information:

- Drive number: The drive's sequential position in the EF2800's drive list
- Drive status: Whether the drive is up or down
- Spare: Displays SPR if the drive is a dedicated spare for the current array
- Channel number: Back-end disk bus number
- Channel and Loop ID: ID for the I/O modules the drive is connected to and the loop ID for the FC disk port
- Size: Size of the drive in MB
- Usage: If a member of an array, this displays the array name and member number. If a spare, this displays the type of spare. If unused, this displays Available. If the drive was part of an array that no longer exists, this displays Leftover.

NOTE: If a drive has failed or malfunctioned, it may not be listed.

To view drive status:

1. From the System Menu, select **Array Menu** and press <Enter>. The Select Array screen displays with a list of existing arrays.
2. Select the array you want and press <Enter>. The array menu displays.
3. Select **Drive Status** and press <Enter>. The drive status screen displays showing the drives that are members of the array and that are assigned as spares (Figure 150). Use the ↑ or ↓ key to scroll through the drives.

Array1
Drv Status Spr? CH:ID CH:ID Size Usage
#01 UP 0:000 1:000 73GB Array01 Member01
#02 UP 0:001 1:001 73GB Array01 Member02
#03 UP 0:002 1:002 73GB Array01 Member03
#04 UP 0:003 1:003 73GB Array01 Member04
#05 UP 0:004 1:004 73GB Array01 Member05
#06 UP 0:005 1:005 73GB Array01 Member06
#07 UP 0:006 1:006 73GB Array01 Member07
#08 UP 0:007 1:007 73GB Array01 Member08
#09 UP 0:008 1:008 73GB Array01 Member09
#10 UP 0:009 1:009 73GB Array01 Member10
#11 UP 0:010 1:010 73GB Array01 Member11
#12 UP 0:011 1:011 73GB Array01 Member12
#13 UP 0:012 1:012 73GB Array01 Member13

Figure 150. Drive Status Screen

4. Press <Esc> to return to the Array Menu.

G.1.1.3 Displaying Drive Errors and Resetting Error Statistics

You can display drive errors for a specific drive. You know a drive has errors when you see the letter E in the first column of the Display Drives screen.

To display drive errors:

1. From the System Menu, select **Display Drives** and press <Enter>. The Display Drives screen displays.

2. If a drive has an "E" next to it, select the drive and press <Enter> to display the error information.

   Some errors are primarily for information purposes to help you diagnose drive and enclosure problems. For more information about SMART errors, refer to the drive manufacturer's specifications. For more information about FC errors, refer to: www.t11.org, click **Drafts**, find the *FC-FS 1.6 T11/02-018v0 dpANS - Fibre Channel Framing and Signaling Interface* document, and go to section 21.

   To reset the error statistics, select **Reset drive error statistics** and press <Enter>.

3. Press <Esc> to return to the list of drives.

G.1.2 Clearing Metadata from a Drive

All of the member drives in an array contain metadata in the first sectors of the drive. The EF2800 uses the metadata to identify array members after restarting or replacing an SM.

You can clear the metadata from a drive if you have a drive that was previously a member of an array. Drives in this state display "Leftover" in the Display Drives screen. After you clear the metadata, you can use the drive in an array or as a spare.

To clear metadata from a drive:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press <Enter>. The Drive Utilities Menu displays.
3. Select **Clear Metadata** and press <Enter>. The Select Drive screen displays showing drives that are not array members.
4. Select the drive you want and press <Enter>. You can now use this drive in an array or as a spare.

G.1.3 Enabling and Disabling Write-back Cache

You can control the write-back cache setting for all of your disk drives at once. Changes take effect after the next rescan or restart. A change to this setting on either SM is automatically updated on the other SM.

This can be set to ENABLE, DISABLE, or DON'T MODIFY (which means the EF2800 should not change any drive's write-back cache settings). The default setting is DISABLE.

Typically, if your drives are part of an array, you do not want to turn on write-back cache on the drives. The EF2800 is already using write-back cache to improve performance. Turning on write-back cache on the disk drive *may* improve performance in some cases, depending on the type of array and how you are using it.

Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

CAUTION ! We recommend that you disable disk write-back cache. Some drives delete their write-back cache if they encounter an internal error, resulting in lost data.

To change the write-back cache setting:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Disk Configuration** and press <Enter>. The Disk Configuration screen displays (Figure 151).

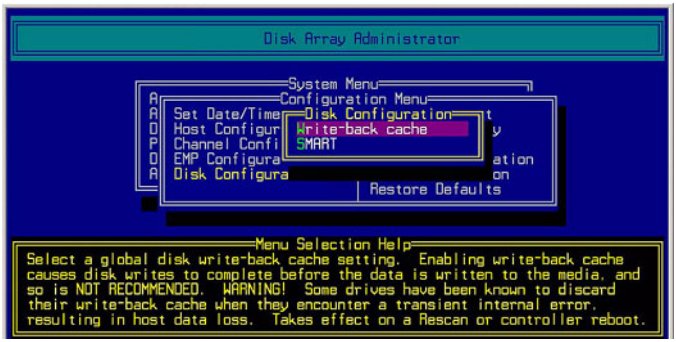
Disk Array Administrator
System Menu
Configuration Menu
Set Date/Time
Host Configur
Channel Confi
EMP Configura
Disk Configura
Disk Configuration
Write-back cache
SMART
Restore Defaults
Menu Selection Help
Select a global disk write-back cache setting. Enabling write-back cache causes disk writes to complete before the data is written to the media, and so is NOT RECOMMENDED. WARNING! Some drives have been known to discard their write-back cache when they encounter a transient internal error, resulting in host data loss. Takes effect on a Rescan or controller reboot.

Figure 151. Disk Configuration Screen

3. Select **Write-back Cache** and press <Enter>. The Write-back Cache screen displays. The current setting is marked with an * next to it.

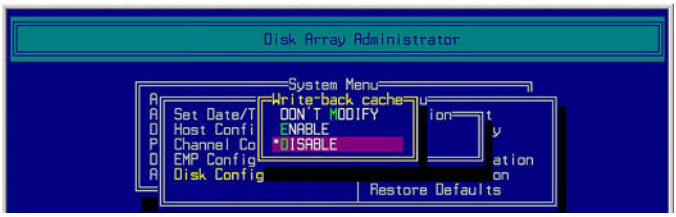

Figure 152. Write-Back Cache Menu

4. Select the option you want and press <Enter>.

5. Restart or rescan to have your changes take effect. (See section H.1.1, "Shutting Down and Restarting the Current SM Module" on page 298 or section H.10, "Rescanning All Channels" on page 314.)

G.1.4 Displaying Disk Cache Status

You can display the cache status of each disk drive. Any disk drives with write-back cache enabled should be connected to a UPS in case of power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

To display disk cache status:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press <Enter>. The Drive Utilities Menu displays (Figure 153).

Figure 153. Drive Utilities Menu

3. Select **Display Drive Cache** and press <Enter>. The Select Drives screen displays.
4. Select a drive and press <Enter>. The Cache Status screen displays showing the status of the read and write cache (Figure 154).

Figure 154. Cache Status Screen

5. Press <Esc> to return to the Drive Utilities Menu.

G.1.5 Enabling and Disabling SMART Changes

You can enable or disable the ability to change the Self-Monitoring, Analysis and Reporting Technology (SMART) settings for all drives connected to the EF2800. This can be set to ENABLE, DISABLE, or DON'T MODIFY (which means the EF2800 should not change any drive's SMART settings). The default setting is DON'T MODIFY.

When you enable SMART, the SMART events are recorded in the event log, which lets you monitor your disk drives or analyze why a drive failed. For more information, see section E.2, "Displaying the Event Log" on page 260. On most drives, SMART is disabled by default by the manufacturer.

A change to this setting on either SM module is automatically updated on the other SM module.

To enable or disable SMART changes:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **Disk Configuration** and press <Enter>. The Disk Configuration screen displays.
3. Select **SMART** and press <Enter>. The SMART screen displays (Figure 155). The current setting is marked with an * next to it.

Figure 155. SMART Menu

4. Select the option you want and press <Enter>.
5. Restart or rescan to have your changes take effect.
   See section H.1.1, "Shutting Down and Restarting the Current SM Module" on page 298 or section H.10, "Rescanning All Channels" on page 314.

G.1.6 Blinking a Drive LED

You can blink the LED on a specific drive one of two ways:

- From the Drive Utilities Menu (only works for a single drive; see below)
- From the Display Drives list when you add a pool spare or display all drives (works for multiple drives). Select the drive and press <B>. Press <B> again to stop the blinking.

To blink a drive LED from the Drive Utilities Menu:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press <Enter>. The Drive Utilities Menu displays.
3. Select **Blink Drive LED** and press <Enter>. The Select Drive screen displays.
4. Select the drive you want and press <Enter>. The drive continues blinking its LED until you do one of the following:
   - Press <Esc> before the Disk Array Administrator times out.
   - Repeat the blink LED command, which toggles the blink LED command off.
5. Press <Esc> to stop blinking the LED.

G.1.7 Taking Down a Drive

CAUTION ! This function is only for testing and could result in data loss. It should not be used in normal operation.

The Down Drive function sets the status of a drive in a fault-tolerant array to down. This forces the EF2800 to remove it from the array and marks the array as critical. At this point, you will be unable to take down any additional drives in the array.

If you have a properly sized dedicated or pool spare, this will cause a reconstruct on the affected array. For more information, see section D.2.5, "Reconstructing an Array" on page 227.

To take down a drive:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press <Enter>. The Drive Utilities Menu displays.
3. Select **Down Drive** and press <Enter. The Select Drive screen displays showing drives that are array members.
4. Select the drive you want and press <Enter>.
5. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the change.

   To make the drive display again, you must use Rescan. See H.10, "Rescanning All Channels" on page 314. After you rescan, you must clear the metadata from the drive before you can use it in an array or as a spare. See section G.1.2, "Clearing Metadata from a Drive" on page 288.

G.1.8 Testing a Drive

This function issues a Test Unit Ready (TUR) command to the selected disk. This just tells you that the drive can respond, but it still may not be functioning properly.

To test a drive:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Drive Utilities Menu** and press <Enter>. The Drive Utilities Menu displays.
3. Select **Test Unit Ready** and press <Enter>. The Select Drive screen displays.
4. Select the drive you want and press <Enter>.

   If the TUR was successful, TUR STATUS OK displays.
   If the TUR was not successful, a failure message displays.
5. Press <Esc> to return to the Drive Utilities Menu.

G.2 Managing Enclosures

An enclosure management processor (EMP) is a device in the enclosure from which the EF2800 can inquire about the enclosure's environmental conditions such as temperature, power supply and fan status, and the presence or absence of disk drives. The EF2800 can also tell the EMP about RAID activities such as drive rebuilds and failed disk drives.

If you have only one EMP, the configuration settings are automatically enabled when the EF2800 is installed. No changes are required to the default configuration settings to support EMP.

If you have more than one EMP, you must set up the EMP LUNs as described in section G.2.1 (EMP LUN) and section G.2.2 (polling interval).

G.2.1 Setting the EMP LUN

If you have only one EMP, the configuration settings are automatically enabled when the EF2800 is installed.

If you have more than one EMP, you must set up the EMP LUNs as described in this section.

The EF2800 allows in-band access to the EMP in the disk enclosure under the EF2800's target ID using direct EMP commands. You can set an EMP LUN to any value between 0 and 63, except where it would conflict with a previously assigned LUN (EMP, array, or CAPI [EF2800]). You can also set it to NONE, which tells the EF2800 not to present a LUN for this EMP under the EF2800's target ID.

You can set LUNs for EMPs that you plan to add by assigning a LUN to the EMP ID you want to use. The EF2800 assigns EMP IDs sequentially each time it starts.

NOTE: EMP LUN settings have no effect on the CAPI interface, which always allows communication with all of the EMPs connected to the EF2800.

You may want to change the EMP LUN if it conflicts with the LUN of another device.

To change the EMP LUN:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **EMP Configuration** and press <Enter>. The EMP Configuration screen displays (Figure 156).

Figure 156. EMP Configuration Menu

3. Select **EMP LUNs** and press <Enter>. The EMP LUNs screen displays.

Figure 157. EMP LUNs Screen

4. Select the EMP you want and press <Enter>. The EF2800 assigns EMP IDs sequentially when it starts. The Set EMP LUN screen displays (Figure 158).

Figure 158. Set EMP LUN Screen

5. Select the option or number you want to use.

If you do not want to assign the EMP a LUN, select **NONE** and press <Enter>. To keep the same LUN for the EMP at all times, select the LUN you want to use and press <Enter>. This can be any number from 0 to 63 that is not already in use.

6. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the change.

7. Restart to have your changes take effect.
See section H.1.1, "Shutting Down and Restarting the Current SM Module" on page 298.

G.2.2 Changing the Additional EMP Setting

You can change one additional EMP setting—polling interval. This is the interval, in seconds, that the EF2800 polls the EMPs for status changes. If the polling rate is set to zero, the EF2800 does not communicate with the EMP. Only use this setting if you suspect you are having communication problems with the EMP. The default setting is five seconds. A change to this setting on either SM is automatically updated on the other SM.

To change the EMP settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **EMP Configuration** and press <Enter>. The EMP Configuration screen displays.

3. Select **EMP Settings** and press <Enter>. The Poll Rate screen displays (Figure 159).

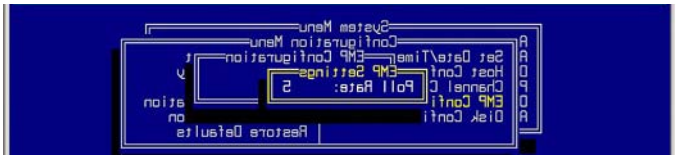

Figure 159. Poll Rate Screen

4. Enter the poll rate you want, in seconds, and press <Enter>.

5. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the changes.

H

Configuring the EF2800

Using the Disk Array Administrator, you can configure settings and perform a variety of functions on the EF2800. You can:

- Shut down and restart the Storage Manager module (see page 298)
- Change the date and time (see page 301)
- View LUN information (see page 305)
- Configure the FC disk channels (see page 307)
- Change the alarm mute setting (see page 308)
- Lock the cache setting (see page 311)
- Enable or disable the battery (see page 312)
- Change the utility priority (see page 313)
- Rescan all channels (see page 314)
- Pause I/O (see page 315)
- Restore the default settings (see page 316)
- Upgrade the firmware (see page 316)

H.1 Shutting Down and Restarting the Storage Manager Module

- Shut down and restart the current SM module: Gracefully shuts down and restarts the SM module you are currently accessing using the Disk Array Administrator software (as shown at the bottom of each screen). Use this option when you have changed a configuration that requires restarting (the procedures say when you need to do this) or when you need to replace the SM module (see page 298).
- Shut down the other SM module: Gracefully shuts down the other SM module (the one you are not currently accessing using the Disk Array Administrator software). Use this option when you need to replace the other SM module or to perform maintenance (see page 299.).
- Shut down both SM modules: Gracefully shuts down both SM modules. Use this option when you need to power down the whole system for maintenance, repair, or a move (see page 300).

H.1.1 Shutting Down and Restarting the Current SM Module

You may need to shut down and restart a SM module after making certain configuration changes. The procedures say when you need to do this.

You should shut down a SM module before you remove it. This shut down is the same as unlocking the handles on the SM module hardware to remove it. Using the shutdown from the Disk Array Administrator lets you see any messages related to the shut down. You cannot see the messages when you unlock the hardware handles.

You should shut down both SM modules when you need to power down the whole system for maintenance, repair, or a move. For more information, see section H.1.3, "Shutting Down Both SM Modules" on page 300.

We strongly recommend that you shut down a SM module gracefully and do not just turn off the power. A normal shutdown ensures that the write-back cache has been flushed to the disk.

To shut down and restart the current SM:

1. From the System Menu, select **Shutdown Menu** and press <Enter>
   The Shutdown Menu displays (Figure 160).

Figure 160. Shutdown Menu

2. Select **Shutdown/Restart** and press <Enter>.

3. The system prompts you to confirm shut down. Select **Yes** and press <Enter>. The system confirms that it has shut down.

4. To restart the SM, press <Enter> to restart.
   The system performs its self-test. When you see the Disk Array Administrator initial screen, the SM is ready.

H.1.2 Shutting Down the Other SM Module

You should shut down the other SM module when you need to remove the other SM module. This shut down is the same as unlocking the handles on the SM module hardware to remove it. Using the shutdown from the Disk Array Administrator lets you see any messages related to the shut down. You cannot see the messages when you unlock the hardware handles.

You should shut down both SM modules when you need to power down the whole system for maintenance, repair, or a move. For more information, see section H.1.3, "Shutting Down Both SM Modules" on page 300.

We strongly recommend that you shut down the SM module gracefully and do not turn off the power. A normal shutdown ensures that the write-back cache is flushed to the disk.

To shut down the other SM module:

1. From the System Menu, select **Shutdown Menu** and press <Enter>. The Shutdown Menu displays.
2. Select **Shutdown Other** and press <Enter>.
3. The system prompts you to confirm shut down. Select **Yes** and press <Enter>. The system confirms that it has shut down.

H.1.3 Shutting Down Both SM Modules

You can simultaneously and gracefully shut down *both* SM modules. Use this in preparation to power down the whole system for maintenance, repair, or a move.

CAUTION ! Shutting down both SMs will cause users to lose access to data and will interrupt the flow of data.

To shut down both SM modules:

1. From the System Menu, select **Shutdown Menu** and press <Enter>. The Shutdown Menu displays.
2. Select **Shutdown Both** and press <Enter>.
3. The system prompts you to confirm shut down. Select **Yes** and press <Enter>. Both SMs shut down.
4. To restart both SM modules, press <Enter> at the same time on both SM modules.

H.1.4 Other Controller Menu

In addition to the previous shutdown menu, "other controller menu" gives the ability to kill or unkill the other SM module, as well as shut down the other or both SM modules.

CAUTION ! If the SM module is the only one working of the redundant pair, then killing the other SM module will cause users to lose access to data and will interrupt the flow of data.

H.2 Changing the Date and Time

You can change the date and time on either SM module. A change to this setting on either SM module is automatically updated on the other SM module.

To set an SM module's date:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Set Date/Time** and press <Enter>. The Set Date/Time screen displays (Figure 161).

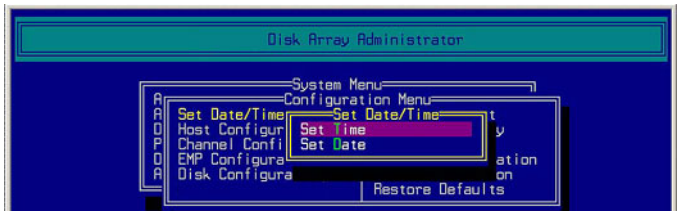

Figure 161. Set Date/Time Menu

3. Select **Set Date** and press <Enter>. The Set Date screen displays (Figure 162).

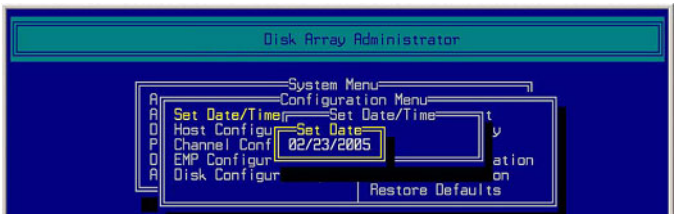

Figure 162. Set Date Screen

4. Enter the date you want and press <Enter>. Enter the date in the following format: MM/DD/YYYY.

5. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the change. The system confirms that the change is made.

6. Press **Esc** to return to the Configuration Menu.

To set an SM module's time:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **Set Date/Time** and press <Enter>. The Set Date/Time screen displays.
3. Select **Set Time** and press <Enter>. The Set Time screen displays (Figure 163).

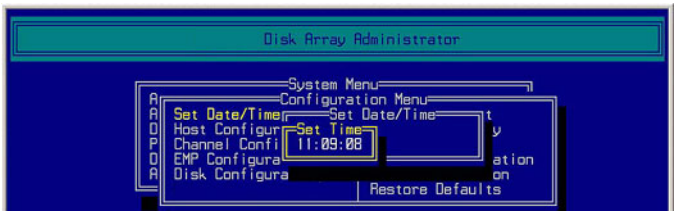

Figure 163. Set Time Screen

4. Enter the time you want and press <Enter>. Enter the time using a 24-hour clock in the following format: hh:mm:ss.
5. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the change. The system confirms that the change is made.
6. Press **Esc** to return to the Configuration Menu.

H.3 Configuring the Host Channels

You can configure several settings for each host channel independently.

- Topology: You should be sure that the topology setting is correct for your configuration. You can set the topology to:
  - LOOP—Use this option for all configurations except when the SM module is connected to a switch F-port. You must use this option if the internal hubs are enabled.
  - POINT-TO-POINT—Use this option only when you connect the SM module to a switch F-port. If you change from Loop to Point to Point mode after already establishing a public loop connection, the switch may ignore subsequent attempts to perform point to point initialization. To resolve this, see section 10.9, "Host Fibre Channel Problems" on page 160.
- Link Speed: You can set the speed to: 1 GB or 2 GB. When you change the link speed, the other host channel on this I/O module changes speed to match.
- Target ID: FC Loop ID—You may need to change the FC Loop ID if you want the SM module to be at a specific address or if your system checks addresses in reverse order (lowest address first). You have two options:
  - SOFT—Use this setting if you do not care whether the SM module's Loop ID changes when you power down and power up. This setting lets the FC loop initialization process determine the Loop ID.
  - Any number between 0 and 125—Select a specific number if you want the Loop ID to stay the same after you power down and power up. The Disk Array Administrator software cannot tell you which Loop IDs are available. To be sure that you have successfully assigned the Loop ID you want, check the Loop ID after you restart the SM module. If the SM module cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.
- CAPI LUN: Each SM module has one LUN that you can change when you configure the host channels. You only need to assign a CAPI LUN if you are using CAPI to configure the EF2800 over a host

channel via SCSI protocol extensions. (for more information about LUNs, see section H.4 on page 305)

- If you are not using CAPI, you can set the CAPI LUN to NONE. If you are using CAPI, you can set it to a value of 0-63. You have two options for setting the LUN:
  - NONE—Use this setting if you are not using CAPI to configure the EF2800.
  - Any number between 0 and 63—Select a specific number if you want the CAPI LUN to stay the same when you restart (this change takes effect immediately unless the CAPI LUN is currently in use).

To configure the host channels:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **Host Configuration** and press <Enter>. The Select Host Channel screen displays.
3. Select the host channel you want to configure and press <Enter>. The Topology screen displays. An * displays next to the current setting.
4. Select the option you want and press <Enter>. The Link Speed screen displays. An * displays next to the current setting.
5. Select the option you want and press <Enter>. The Target ID screen displays.
6. Select the option or number you want and press <Enter>. The CAPI LUN screen displays.
7. Select the option or number you want to use. There is just one CAPI LUN for each SM module.
8. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the changes.

H.4 Understanding LUNs and Viewing LUN Information

Each SM module supports up to 64 FC logical unit numbers (LUNs), or 128 after a failover, that are numbered zero through 63. There are three different types of LUNs: CAPI, EMP, and partition. You can view information about each LUN (see section H.4.1).

The three types of LUNs have the following characteristics:

- CAPI LUN: Allows CAPI to configure the SM module. Each EF2800 can have a CAPI LUN. You only need to assign a CAPI LUN if you are using CAPI to configure the EF2800 over a host channel using SCSI protocol extensions. If you are not using CAPI, you can set the CAPI LUN to NONE. If you are using CAPI, you can set it to a value of 0-63. For more information about changing the CAPI LUN, see section H.3.

  Note: Most UNIX, Linux, and Macintosh operating systems require that the CAPI LUN be set to a higher value than all array LUNs. Before creating your first array, change the CAPI LUN to a higher value. If you are using a custom software application to configure and manage the controller (this application uses CAPI to communicate with the controller), you must have a CAPI LUN. If you are not using a custom application, and therefore are not using CAPI, select NONE as the CAPI LUN. This allows your first array to be seen at LUN 0.

- EMP LUNs: Allow access to EMPs. You can set an EMP LUN to a value of 0-63 or NONE. NONE means that the EMP cannot be accessed via a LUN. For information about changing the EMP LUN, see section G.2.1, "Setting the EMP LUN" on page 294.

- Partition LUNs: Allow access to partitions on the SM module. You can set partition LUNs to any numeric value from 0-63. For information about changing the partition LUN, see section D.3.5, "Changing a Partition LUN" on page 245.

H.4.1 Viewing LUN Information

You can view information for each existing LUN.

To view LUN information:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays (Figure 164).

Figure 164. Utilities Menu

2. Select **LUN information** and press <Enter>**.** The LUN Information screen displays (Figure 165).

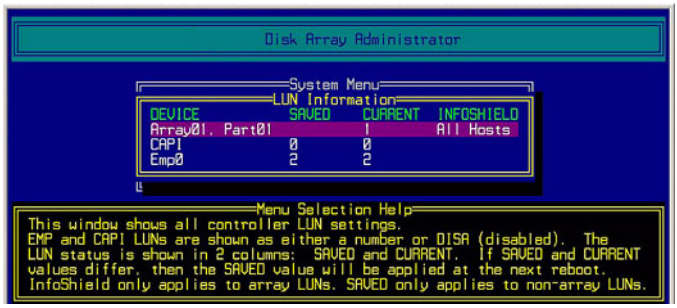
Disk Array Administrator
System Menu
LUN Information
DEVICE SAVED CURRENT INFOSHIELD
Array01, Part01 1 All Hosts
CAPI 0 0
Emp0 2 2
Menu Selection Help
This window shows all controller LUN settings.
EMP and CAPI LUNs are shown as either a number or DISA (disabled). The
LUN status is shown in 2 columns: SAVED and CURRENT. If SAVED and CURRENT
values differ, then the SAVED value will be applied at the next reboot.
InfoShield only applies to array LUNs. SAVED only applies to non-array LUNs.

Figure 165. LUN Information Screen

3. Press <Esc> to return to the Utilities Menu.

H.5 Configuring the FC Disk Channels

You can change two configuration options for each FC disk channel:

- Link speed: This is the maximum speed the EF2800 will attempt to negotiate. You can set the speed to: 1 GB/second or 2 GB/second. The Link Speed setting is set on the Ops Panel switches (see section 1.2.2.1 on page 6.
- Initiator ID assigned to each channel: The EF2800 assigns each of its FC disk channels one of the FC loop IDs (initiator IDs). The Initiator ID setting is set via the Disk Array Administrator. You can change the initiator ID assigned to each channel. You may need to do this if the default ID, 125, conflicts with an EMP ID. You have two options:
  - SOFT: Use this setting if you do not care whether the channel's initiator ID changes when you power down and power up. This setting lets the FC loop initialization process determine the initiator ID.
  - Any number between 0 and 125: Select a specific number if you want the initiator ID to stay the same after you power down and power up. The Disk Array Administrator software cannot tell you which IDs are available. To be sure that you have successfully assigned the ID you want, check the ID after you restart the EF2800. If the EF2800 cannot get the specified Loop ID during the loop initialization process, it will try to get a soft address.

To configure the FC disk channels:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **Channel Configuration** and press <Enter>. The Select Disk Channel screen displays (Figure 166).

Figure 166. Select Disk Channel Screen

3. Select the channel you want and press <Enter>.
4. Select the initiator ID you want and press <Enter>.
5. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the changes.
6. Press <Esc> to return to the Configuration Menu.

H.6 Changing the Alarm Mute Setting

You can enable or disable the audible alarm that sounds when the EF2800 becomes too hot, detects low or high voltage, or an array becomes critical or offline. Changing the mute setting lets you turn off the alarm when it is sounding. You should turn it back on after resolving the problem.

You can also use the Mute button on the EF2800 Ops Panel to turn off the alarm when it sounds.

The alarm sounds for temperature or voltage conditions (events). Warning events are generated when the temperature or voltage enters the warning range. Shutdown events are generated when the temperature or voltage enters the shutdown range. After reaching the shutdown range, the EF2800 will not function. You must resolve the problem and restart the EF2800. If the problem is not resolved, it will shut down again.

Alarm conditions trigger an event message that displays in the Disk Array Administrator software window and in the event log. See section E.5, "Capturing Event Log, Hardware, and Configuration Information" on page 270.

A change to this setting on either SM module is automatically updated on the other SM module.

Figure 167 shows the temperature and voltage thresholds for each alarm and what to do to resolve the problem.

Figure 167. .Alarm thresholds

Alarm threshold	What to do when the alarm sounds
EF2800 internal temperature • Warning: 0°C to 4°C and 66°C to 70°C • Shutdown: <0°C and >70°C	• Check the Disk Array Administrator software to confirm what the alarm means. See section E.2 on page 260. • Check the ambient temperature and lower it, if needed. Ambient temperature should be less than 45°C. • Check that the EF2800 has good airflow clearance. The EF2800 requires airflow clearance on all sides, except the bottom and top. • Check that the internal fans are running. The fans are in the Power Managers.
EF2800 CPU temperature • Warning: 0°C to 4°C and 91°C to 100°C • Shutdown: <0°C and >100°C	• Same as above.
VCC voltage • Warning: 5 V -10% to -8% and +8% to +10% • Shutdown: 5 V <-10% and >+10%	• Check the Disk Array Administrator software to confirm what the alarm means. See section E.2 on page 260. • If it is a warning alarm, let the EF2800 continue to operate. • If it is a shutdown alarm, see which SM module is showing the alarm. If only one SM module shows the alarm, replace that SM module. If it is both, you must troubleshoot the Power Supply/Cooling modules.

Figure 167. .Alarm thresholds

Alarm threshold	What to do when the alarm sounds
12V voltage • Warning: 12 V -20% to -10% and +10% to +20% • Shutdown: 12 V <-20% and >+20%	• Same as above for the VCC voltage.
2.5 V voltage • Warning: 2.5 V -10% to -8% and +8% to +10% • Shutdown: N/A	• Same as above for the VCC voltage.

To enable or disable the alarm:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Alarm Mute** and press <Enter>. The Alarm Mute menu displays (Figure 168). The current setting is marked with an * next to it.

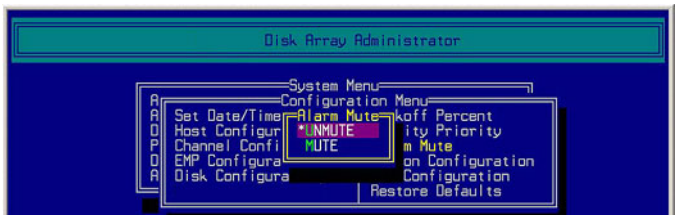

Figure 168. Alarm Mute Menu

3. Select the option you want and press <Enter>.

H.7 Locking the Cache Setting

You can prevent host systems from using SCSI mode-select commands to change the EF2800 system's write-back cache setting. Some operating systems disable write cache. If cache lock is enabled, the host cannot modify the cache setting. The default setting is disabled.

This option is useful in some environments where the host system disables the SM module's write-back cache, resulting in degraded performance. A change to this setting on either SM module is automatically updated on the other SM module.

To lock the cache setting:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Option Configuration** and press <Enter>. The Option Configuration screen displays (Figure 169).

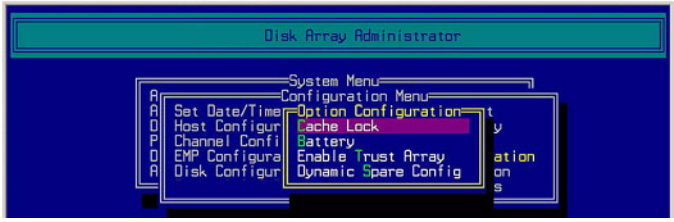

Figure 169. Option Configuration Menu

3. Select **Cache Lock** and press <Enter>. The Cache Lock screen displays (Figure 170). The current setting is marked with an * next to it.

Figure 170. Cache Lock Menu

4. Select the option you want and press <Enter>.

H.8 Enabling and Disabling the Battery

If you are not using a battery in your EF2800, the EF2800 will activate an alarm. To eliminate the alarm, you can disable the battery. The default setting is battery enabled.

NOTE: You should only disable the battery if you are running the EF2800 with an Uninterruptible power supply (UPS), so that you will not lose power to the EF2800.

If you disable the battery, the EF2800 will *not* give any warnings, nor will it disable the write-back cache.

If you change this setting, you must restart the EF2800 for the change to take effect.

To change the battery setting:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Option Configuration** and press <Enter>. The Option Configuration screen displays.

3. Select **Battery** and press <Enter>. The Battery screen displays (Figure 171). The current setting is marked with an * next to it.

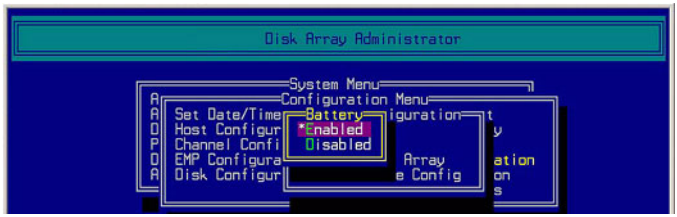

Figure 171. Battery Menu

4. Select the option you want and press <Enter>.

5. Restart to have your changes take effect (see section H.1 on page 298).

H.9 Changing the Utility Priority

You can change the priority at which all utilities (Verify, Reconstruct, Expand, Initialize, etc.) run when there are active I/O operations competing for the EF2800 system's CPU. The choices are:

- High (default)
- Medium
- Low

For example, select High if your highest priority is to get the array back to a fully fault-tolerant state. This causes heavy I/O with the host to be slower than normal. Select Low priority if streaming data without interruption, such as for a Web server, is more important than data redundancy. This allows the Reconstruct or other utility to run at a slower rate with minimal effects on host I/O.

To change the utility priority:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **Utility Priority** and press <Enter>. The Utility Priority screen displays (Figure 172). The current setting is marked with an * next to it.

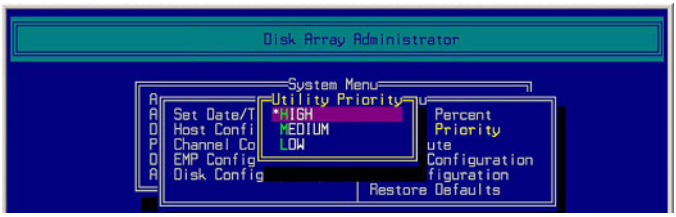

Figure 172. Utility Priority Menu

3. Select the option you want and press <Enter>.

H.10 Rescanning All Channels

You can tell the EF2800 system to scan all disk channels for new or removed disk drives. You can use this option when you install or remove drives. The rescan temporarily pauses all I/O processes and then resumes normal operation.

If you are using an enclosure with an EMP, the EF2800 will perform a rescan automatically. With an EMP, the EMP detects the change in drive status and updates the EF2800 about removed drives almost immediately; however, installed drives will be detected after a three-minute delay. This delay is to allow the new drives to spin up.

To rescan all channels:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays (Figure 173).

Figure 173. Utilities Menu

2. Select **Rescan** and press <Enter>.

H.11 Pausing I/O

Most drive enclosures allow you to remove and replace drives while FC disk channel activity continues. However, you may still want to pause I/O if you are replacing more than one disk drive. The Hot Swap Pause option suspends activity on all device channels used in the EF2800, thereby ensuring data integrity on the connected drives and arrays.

CAUTION ! Pausing I/O halts active I/O to the host.

NOTE: If you are not sure that your enclosure supports hot swapping, use the Hot Swap Pause option before you remove or replace any drives in an array.

To pause I/O:

1. From the System Menu, select **Utilities Menu** and press <Enter>. The Utilities Menu displays.
2. Select **Hot Swap Pause** and press <Enter>. The Bus Paused screen displays (Figure 174).

Figure 174. Hot Swap Pause Screen

3. When you have replaced the drive, resume back end activity by pressing <Esc>.

CAUTION ! Do not stay in the Hot Swap Pause mode for too long; otherwise, an operating system time-out may occur (the time varies according to the operating system). For example, in Windows NT, the default limitation during I/O activity is 10 seconds.

H.12 Restoring Default Settings

You can restore all of the EF2800 system default settings. You may want to do this if the EF2800 is not working properly and you cannot determine why. This lets you then change the settings that are critical to your configuration.

To restore the default settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **Restore Defaults** and press <Enter>. The Restore Defaults screen displays.
3. The system prompts you to confirm changes. Select **Yes** and press <Enter> to make the change. The system confirms that the change is made.
4. Press <Enter> to return to the Configuration Menu.

H.13 Updating Firmware

You can update five types of firmware for each EF2800 system:

- Storage Manager
- Storage Manager loader
- Memory controller
- LAN subsystem
- LAN subsystem loader

Information regarding the latest release of firmware and firmware updates is available from technical support.

H.13.1 Updating SM, SM Loader and Memory Controller Firmware

You use the Flash Utility to download new firmware (.fla file) for your SM modules, memory controller, and the storage controller loader. The Flash Utility is resident in the embedded firmware of the SM modules. You can access the Flash Utility using either your RS-232 or Ethernet connection to the SM module. If you want to use the Ethernet connection, your Telnet utility must support either the Kermit or Xmodem protocol.

To upgrade the Storage Manager, Storage Manager Loader and Memory Controller firmware, follow these steps:

1. Call technical support for information about downloading the firmware updates.

2. From the computer connected to the SM module, access the Disk Array Administrator software.

3. From the System Menu, select **Shutdown Menu** and press <Enter>. The Shutdown Menu displays.

4. Select **Shutdown/Restart** and press <Enter>. The system confirms that you want to shut down. Select **Yes** and press <Enter>. The system confirms that it has shut down.

5. Press <Enter> to restart.

6. While the SM module restarts, hold down the spacebar on your keyboard. The Flash Utility screen displays (Figure 175).

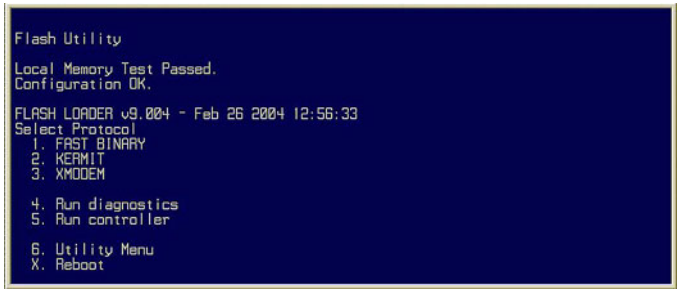

Figure 175. Flash Utility Screen

7. Press the number on your keyboard that corresponds to the protocol you want to use to transfer the firmware upgrade file from your computer to the SM module. We recommend using the KERMIT protocol.

   The system shows that it is ready to use KERMIT.

8. Using your terminal emulator software, send the.fla file using KERMIT.

   If you are using HyperTerminal, select **Transfer** > **Send File**, navigate to where the firmware update file is located, select it, and click **Open**. Select the same Protocol from the drop-down list that you selected from the Flash Utility screen. Click **Send**.

   The file transfers. The system displays messages showing that it is flashing the code and restarting the SM module.

CAUTION ! Do not interrupt the power when transferring the new firmware.

---

9. Repeat steps 2 through 8 above on the other SM module.

H.13.2 Updating LAN Firmware

You can also update the firmware for the LAN subsystem inside the SM modules and the LAN subsystem loader. The firmware is contained in a.bfl file.

Updating the LAN firmware works best from a system that is *not* running Windows 95 or 98. When using Windows 95 or 98, you received a timeout message even though the ftp process is continuing. If you upgrade the LAN firmware from other operating systems, such as Windows NT or Windows 2000, you do not receive this message.

To upgrade the LAN subsystem's firmware:

1. Check the version of LAN firmware you have now by pressing <Ctrl>-<E> until the configuration information screen with that information displays.

2. Call technical support for information about downloading the firmware updates.
3. From the computer connected to the SM module, access the DOS window.
4. At the DOS prompt change to the directory where you downloaded the.bfl file.
5. Enter: ftp [SM module's IP address]
6. At the User prompt enter: flash
7. At the Password prompt enter: flash
8. At the FTP prompt enter: bin
9. At the FTP prompt enter: put [.bfl file name] flash

   If you are using Windows 95 or 98, you will see a timeout message (Connection closed by remote host), but the ftp process is continuing. You can ignore the timeout message. Wait a few minutes and check the firmware version.

   If you are using another operating systems, you will see the downloading progress displayed on the screen.
10. When you see the restarting message, wait 60 seconds.
11. Check the version of LAN firmware you have now to make sure the firmware update worked by pressing <CTRL>-<E> until the configuration information screen with that information displays.
12. Repeat steps 3 through 11 above on the other SM module.

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I

LAN Configuration

Before you can access the Disk Array Administrator software using the Ethernet port, you must set up each SM module for TCP/IP. The following sections describe the TCP/IP setup.

A SM module that is part of a TCP/IP network requires three basic IP configuration elements: IP address, subnet mask, and default gateway IP address. The SM module's IP address must be unique to the network in which the SM module resides. If the SM module is part of a publicly routed network (that is, attached to the Internet), the address must be globally unique.

This appendix describes how to configure the TCP/IP settings for the first time starting from the factory-set defaults.

I.1 Configuring the SM for TCP/IP

Before you can access the Disk Array Administrator software using the Ethernet port, you must set the IP address and subnet mask for the SM module. The default IP address is 10.0.0.1. You can do this by one of the following ways:

- Setting up your computer with an IP address that is compatible with the SM module default of 10.0.0.1, such as 10.0.0.42.
- Using the serial connection to the SM module and setting the address. See section I.2.1 on page 322.

I.2 Configuring the LAN Settings

You can configure several LAN settings for each SM using the Disk Array Administrator software:

- IP settings (see page 322)
- FTP settings (see page 323)
- Telnet settings (see page 324)
- SNMP settings (see page 324)
- Contact settings (see page 325)
- HTTP settings (see page 326)
- Security options (see page 326)
- Reset LAN Subsystem (see page 328)

I.2.1 Configuring the IP Settings

You can set three IP-related settings:

- IP Address: Internet Protocol address of the SM module. Factory default is 10.0.0.1. You need two IP addresses, one for each SM module.
- IP Mask: Subnet mask. Factory default is 255.255.255.0.
- Gateway: Optional Factory default is 0.0.0.0. See your LAN administrator for more information.

If you are not sure what IP address, subnet mask, and gateway to use, contact your LAN administrator.

Record the IP addresses, IP mask, and gateway below:

- IP address for SM module A _____
- IP address for SM module B _____
- IP mask _____
- Gateway _____

To set the IP address, subnet mask, or gateway:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **IP Settings** and press <Enter>. The IP Settings screen displays.
4. Select the option you want and press <Enter>. The screen displays related to the option you selected.
5. Enter the IP address, subnet mask, or gateway you want and press <Enter>.
6. The system prompt you to confirm changes. Select **Yes** and press <Enter>. The system makes the change.

I.2.2 Configuring the FTP Settings

You can set two FTP-related settings:

- Login: Login name for FTP access to the SM module. You can use FTP to download firmware updates. You can enter up to 15 characters. The default is flash.
- Password: Password for FTP access to the SM module. You can enter up to 15 characters. The default is flash.

Changes to either of these settings on either SM module are automatically updated on the other SM module.

To set the FTP settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **FTP Settings** and press <Enter>. The FTP Settings screen displays.
4. Select the option you want and press <Enter>. The screen displays related to the option you selected.
5. Enter or select the option you want and press <Enter>.
6. The system prompts you to confirm change. Select **Yes** and press <Enter>. The system makes the change.

I.2.3 Configuring the Telnet Settings

You can set two Telnet-related settings:

- Password: Password for accessing the SM module using the Ethernet port and Telnet. You can enter up to 32 characters. The default is null (press <Enter>).
- Timeout: Number of idle minutes before the Telnet session times out. The default is no timeout, which is shown as 0 minutes in the Disk Array Administrator.

Changes to either of these settings on either SM module are automatically updated on the other SM module.

To set the Telnet settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **Telnet Settings** and press <Enter>. The Telnet Settings screen displays.
4. Select the option you want and press <Enter>. The screen displays related to the option you selected.
5. Enter or select the option you want and press <Enter>.
6. The system prompts you to confirm change. Select **Yes** and press <Enter>. The system makes the change.

I.2.4 Configuring the SNMP Settings

You can set six Simple Network Management Protocol (SNMP)-related settings:

- Trap Host: Host computer's IP address that is set up to receive SNMP traps. The default is 0.0.0.0.
- Traps Enable: On or off toggle to enable SNMP traps. The default is No (disabled).
- Read Community: SNMP read password. The default is Public.

- Write Community: SNMP write password. The default is Private.
- Event Filter: Informational, Warning, or Error. The default is Warning.
- Trap Filter: Informational, Warning, or Error. The default is Warning.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To set the SNMP settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **SNMP Settings** and press <Enter>. The SNMP Settings screen displays.
4. Select the option you want and press <Enter>. The screen displays related to the option you selected.
5. Enter or select the option you want and press <Enter>.
6. The system prompts you to confirm change. Select **Yes** and press <Enter>. The system makes the change.

I.2.5 Configuring the Contact Settings

You can set four contact settings:

- System Name: Name of the EF2800 as seen by other systems on the LAN. You can enter up to 80 characters. The default is Uninitialized Name.
- System Contact: Name of a contact person responsible for the EF2800. You can enter up to 80 characters.
- System Location: Location of the EF2800. You can enter up to 32 characters.
- System Information: Read-only screen with information about the system.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To set the contact settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.

2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.

3. Select **Contact Settings** and press <Enter>. The Contact Settings screen displays.

4. Select the option you want and press <Enter>. The screen displays related to the option you selected.

5. Enter or select the option you want and press <Enter>.

6. The system prompts you to confirm change. Select **Yes** and press <Enter>. The system makes the change.

I.2.6 Configuring the HTTP Settings

You can set up the passwords for SAM, the browser-based interface. In SAM, you can set up two types of SAM users:

- Monitor: Have access to only the **Monitor** menu that lets you view the status and statistics pages. If you have logged in using a monitor password and select a page from the **Manage EF2800** menu, SAM displays the Login page, where you can log in with the manage password. SAM then takes you to the page you requested. Three monitor users can be logged in at a time to each SM module.
- Manage: Have access to all SAM functions. Only one such user can be logged in at a time to each SM module.

NOTE: SAM permits one manage user to log in to each SM module at the same time. If two users log in this way, their configuration changes could conflict.

To set the HTTP settings:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **HTTP Settings** and press <Enter>. The HTTP Settings screen displays.
4. Select the password you want to change and press <Enter>. The screen displays related to the password you selected.
5. Enter the new password you want and press <Enter>.
   You can enter up to 15 characters for each password. You can only use letters, numbers, and underscores.
6. The system prompts you to confirm changes. Select **Yes** and press <Enter>. The system makes the change.

I.2.7 Configuring the Security Options

You can enable or disable the following LAN-related functions:

- Telnet: Controls access to the SM modules using Telnet, which permits you to manage the EF2800s using your LAN. The default is enabled.
- FTP: Controls access to the SM modules using file transfer protocol (FTP), which permits you to upgrade the SM module's LAN Subsystem firmware. The default is enabled.
- HTTP: Controls access to the SM modules using hypertext transfer protocol (HTTP), which permits you to manage the SM modules using SAM. The default is enabled.
- SNMP: Controls the availability of SNMP, which permits remote monitoring of the EF2800 using your LAN. The default is enabled.
- Internet Debug: Used for diagnosing problems during the technical support process. We recommend that this remain disabled unless support personnel tell you to enable it. The default is disabled.

Changes to any of these settings on either SM module are automatically updated on the other SM module.

To change any of the security options:

1. From the System Menu, select **Configuration Menu** and press <Enter>. The Configuration Menu displays.
2. Select **LAN Configuration** and press <Enter>. The LAN Configuration screen displays.
3. Select **Security Options** and press <Enter>. The Security Options screen displays.
4. Select the option you want and press <Enter>. The screen displays related to the option you selected. The current option has an * next to it.
5. Select **Enable** or **Disable** and press <Enter>. The system makes the change.

I.2.8 Resetting the LAN Subsystem

If you are having difficulty communicating with the SM module using the Ethernet connection, you can reset the LAN Subsystem in the SM module.

To reset the LAN Subsystem:

1. From the System Menu, select **Shutdown Menu** and press <Enter>. The Shutdown Menu displays.
2. Select **Reset LAN Subsystem** and press <Enter>.
3. The system prompts you to reset. Select **Yes** and press <Enter>. The system resets the LAN Subsystem.

Glossary

In glossary definitions, *italics* are used for items defined elsewhere in the glossary and **bold** is used for the items shown in brackets after the main heading of the entry.

Address An address is a data structure or logical convention used to identify a unique entity, such as a particular process or network device.

Arbitrated Loop Physical Address (AL_PA) An AL_PA is a 1-byte value used in an arbitrated loop topology. This value is used to identify L_Ports. The value then becomes the last byte of the address identifier for each public L_Port on the loop.

ASCII American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as $,!, and /. Supported by almost every computer and terminal manufacturer.

Attribute Setting that controls access to a specific file. Often used to protect important files (such as the Registry files) from accidental change or deletion. Set using the ATTRIB command in MS-DOS.

Backplane A printed circuit board incorporated in the chassis assembly to provide logic level signal, and low voltage power distribution paths.

Bay The slot that a unit or media device fits into.

Bifurcated (power cord) Throughout this user guide, the term is used as the UK equivalent of the US term furcated.

A bifurcated power cord is a two branched cord joined together by a yoke

Bus See channel.

Byte A group of binary digits stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers), or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte (K) is equal to 1,024 bytes or characters; 64K indicates 65,536 bytes or characters.

Cable Throughout this EF2800 user guide this term is used in accordance with the preferred US context of: "an insulated flexible electric wire used for the transmission of data signals between computer equipment." **Note**: Cable is UK preferred terminology for either a power cord or a data cable:

CAPI EF2800 Configuration Application Programming Interface is available for software engineers who need to develop a programmed interface for managing EF2800 products.

Channel A channel is a common physical path composed of wires or other media, across which signals are sent from one part of a computer to another. A channel is a means of transferring data between modules and adapters, or between an adapter and SCSI or Fibre Channel devices. A channel topology network consists of a single cable trunk that connects one workstation to the next in a daisy-chain configuration. All nodes share the same medium, and only one node can broadcast messages at a time.

Character A representation, coded in binary digits, of a letter, number, or other symbol.

Characters Per Second A data transfer rate generally estimated from the bit rate and the character length. For example, at 2400 bps, 8-bit characters with Start and Stop bits (for a total of ten bits per character) will be transmitted at a rate of approximately 240 characters per second (cps).

Chassis A sheet metal enclosure incorporating a Backplane PCB and module runner system. The chassis contains a number of 'Bays', each of which can accommodate a plug in module. There are sixteen *drive* carrier bays at the front and five bays at the rear which house *power supply/cooling* and *LRC I/O modules* and also the *Ops Panel*.

Configure To set up a hardware device and its accompanying software.

Controller "A" In a redundant controller environment, one controller is designated as controller "A" and the other controller is designated as the controller "B". Controller identity is determined by enclosure hardware. The controller's identity displays continuously at the bottom of the Disk Array Administrator screens. See *Storage Manager*.

Data Communications A type of communications in which computers and terminals are able to exchange data over an electronic medium.

Disk (drive, carrier, module) An FC-AL disk **drive** mounted in a **carrier**. You can have up to sixteen disk *drive carrier modules* in each EF2800 enclosure.

Enclosure The chassis assembly which houses the plug-in modules that make up the EF2800 storage Subsystem.

ESI/Ops module A unit used to monitor and control all elements of the Enclosure. The **ESI/Operators (Ops)** panel is supplied as an integral part of the EF2800 enclosure core product

Fabric Fabric refers to a switched topology, which is one of the three FC topologies. Fabric elements, which are responsible for frame routing, interconnect various N_Ports or NL_Ports. Connections to fabric can use loop (public loop) or point to point.

Failback In Active-Active mode, failback is the act of returning ownership of controller resources from a surviving controller to a previously failed (but now active) controller. The resources include disk arrays, cache data, and host ID information.

Failover In Active-Active mode, failover is the act of temporarily transferring ownership of controller resources from a failed controller to a surviving controller. The resources include disk arrays, cache data, and host ID information.

FC adapter An FC adapter is a printed circuit assembly that translates data between the FC host processor's internal bus and FC link.

FC Arbitrated Loop (FC-AL) FC-AL is one of three FC topologies in which ports use arbitration to establish a point-to-point circuit. Arbitrated loops allow multiple ports to be connected serially in a single loop. Up to 126 NL_Ports and 1 FL_Port can be configured in a unidirectional loop. Ports arbitrate for access to the loop based on their AL_PA. Ports with lower AL_PAs have higher priority than ports with higher AL_PAs. FC-AL can be public, typically connected using switched fabric, or private, typically a direct host connection or hub.

FC device A device that uses FC communications is referred to as an FC device.

FC port An FC port is the opening at the back of a router that provides a fiber optic connection between the FC adapter and FC host.

FC protocol for SCSI (FCP) FCP defines an FC mapping layer (FC-4) that uses FC-PH services to transmit SCSI command, data, and status information between a SCSI initiator and SCSI target. FCP enables transmission and receipt of SCSI commands, data, and status across the FC using standard FC frame and sequence formats.

Fibre Fibre is a generic FC term that refers to all transmission media types specified in the FC Physical Layer standard (FC-PH), such as optical fiber, copper twisted pair, and copper coaxial cable.

Fibre Channel (FC) FC is a bidirectional, point-to-point serial data channel, structured for high-performance capability. In the physical sense, an FC is an interconnection of multiple communication points, called N_Ports, by a switching network (fabric). FC transports incoming data from devices by reading the buffer information, packaging it, and sending the information across the fabric. Although FC is a generalized transport mechanism that has no protocol of its own or native I/O command set, it can transport any existing upper-level protocol such as SCSI and IP. FC offers high-speed data transfer rates. FC is most commonly used to connect clustered servers to storage systems. ANSI has developed standards for FC.

gigabit interface converter (GBIC) A GBIC, also referred to as a Physical Link Module, is a physical component that manages functions of the FC-0 layer. This layer consists of the physical characteristics of the media and interface, including drivers, transceivers, connectors, and cables. A GBIC attaches to an FC adapter and connects a router to an FC host.

High Voltage Differential (HVD) HVD is a differential SCSI scheme with terminators that run on 5 volts.

Host Bus Adapter (HBA) An HBA is the critical link between a host server or workstation and a storage Subsystem, integrating computing platforms, operating systems, and I/O protocols to ensure proper inter operability and functionality. The bus adapter provides direct storage connectivity from the system to data within the storage Subsystem and enables stable, high-speed transmission of information and files. HBAs manage the controller-specific aspects of handling a storage driver interface device implemented as a target driver, which supports mass storage peripheral devices such as disks and tapes. A storage driver interface is used to implement SCSI and other storage device drivers. An HBA connects to the storage Subsystem to the host computer and uses either fiber or copper media.

Hot plugging A device with the capability of being connected to a Subsystem without interrupting the power supplies to that Subsystem.

Hot swap Hot swapping is the term used for manually swapping a failed disk unit with a replacement while the EF2800 Subsystem is in normal use.

Hz (Hertz) a frequency measurement unit used internationally to indicate cycles per second.

in-band Method of accessing and managing the SM controller or EF2800 Subsystem using the SCSI or FC host connection. This type of access is available using CAPI to develop a programmed interface.

Initialize To prepare a hardware device for use.

Initiator An initiator is an FC or SCSI device that contains application clients that originate service requests and task management functions for processing by a target FC or SCSI device.

initiator mode Initiator mode is the configuration mode of a device in which an FC or SCSI initiator requests operations to be performed by an FC or SCSI target device.

Kill In Active-Active mode, one controller can kill the other controller by resetting it and taking it offline.

LED Light Emitting Diode. A small light displayed on the cabinet, disk units and power supply units.

Logical Unit Number or Logical Unit (LUN) A LUN is a subdivision of a SCSI target. For SCSI-3, each SCSI target supports up to 128 LUNs. An FC host using LUNs can address multiple peripheral devices that may share a common controller.

loop address Loop address is an FC term that indicates the unique ID of a node in FC loop topology. A loop address is sometimes referred to as a Loop ID.

Loop Resiliency Circuit (LRC): Circuits within the *SM modules* which provide loop resiliency in the event of a drive failing or being unplugged.

Low Voltage Differential (LVD) LVD is a method of powering SCSI cables that will be formalized in the SCSI-3 specifications. LVD uses less power than the current differential drive (HVD), is less expensive, and allows for higher speeds such as those of Ultra2 SCSI. LVD requires 3.3 volts (versus 5 volts for HVD).

LRC I/O module A plug-in Input/Output module used to connect the internal FC-AL channels from the EF2800 backplane to the rear of the enclosure.

Management Information Base (MIB) A MIB is a database of managed objects accessed by network management protocols. An SNMP MIB is a set of parameters that an SNMP management station can query or set in the SNMP agent of a network device (such as a router).

mapping table A mapping table is a table indexed by sequential LUN values. The values indicate select bus:target:LUN devices. Mapping tables are used by some routers to perform FC-to-SCSI operations by default.

Module (drive carrier, power supply/cooling, storage manager) A module is a power supply, disk drive or electronics unit held in a carrier that plugs into a bay inside the enclosure. An EF2800 enclosure can contain sixteen ***drive carrier*** *modules*, two ***power supply/cooling*** *modules* and two ***Storage Manager*** *modules*.

Operating system The software running the host computer. For example, on PCs it is often Windows 95/98, Windows NT or OS/2 and on Hewlett-Packard machines it could be HP-UX.

other controller or SM The opposite controller or Storage Module (SM) from the one currently being used (that is, not the local controller or SM that you are connected to) is referred to as the other.

out-of-band Method of accessing and managing the EF2800 controller or Subsystem using the RS-232 or Ethernet, if available, connection.

ownership In an active-active configuration, a single controller has ownership of the following resources: arrays and dedicated spares. When a controller fails, the other controller assumes temporary ownership of its resources

Parallel Transmission The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See *Serial Transmission*.

partition A partition is a logical subdivision of an array to which you can assign a LUN. You can add, expand, rename, change the LUN, and delete partitions using the RAID controller's software. This type of partition is not the same as a partition you create with your operating system or third party tools.

point to point A point-to-point connection is a dedicated communication link between two devices as an alternative to FC-AL. This term is used to refer to a link between the controller or router (N-port) and the F-port on a switch. The EF2800 supports point-to-point connections to fabric ports only (sometime referred to as F-ports).

Power Cord Throughout this EF2800 user guide this term is used in accordance with the preferred US context of: "an insulated flexible electric wire fitted with connectors at each end and used for the transmission of electrical power to computer equipment.

Power Supply/Cooling module One module in the EF2800 family of RAID products. Power Supply/Cooling modules contain the power supply and two cooling fans.

Protocol A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

Redundant Not essential.

router A router is a device that enables connectivity between SCSI devices and FC networks. It routes each data command to the appropriate SCSI channel based on the address it is intended for.

SAM (Storage Array Manager) For the EF2800 family of RAID products, provides a browser-based interface for configuring, managing, and monitoring the EF2800. In both the user interface and the documentation, it is often referred to as SAM.

SCSI adapter A SCSI adapter is a 16-bit fast/wide or 8-bit narrow, single-ended or differential physical connection between a router and SCSI devices. Each SCSI adapter supports up to 16 (fast/wide) or 8 (narrow) SCSI devices, including itself.

SCSI addressing Each device supported by a SCSI adapter has its own unique SCSI address, which dictates the device's priority when arbitrating for access to the SCSI bus. A SCSI address of 7 has the highest priority. For a fast/wide SCSI adapter that supports up to 16 devices, the next highest priority address is 6, then 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8. A narrow SCSI adapter supports up to eight devices, including itself. The SCSI address 7 has the highest priority, followed by 6, 5, 4, 3, 2, 1, and 0.

SCSI bus A SCSI bus provides a means of transferring data between SCSI devices. A SCSI bus is either an 8- or 16-bit bus that supports up to 8 or 16 devices, including itself. The bus can consist of any mix of initiators and targets, with the requirement that at least one initiator and one target must be present.

SCSI device A SCSI device is a single unit on a SCSI bus that originates or services SCSI commands. A SCSI device is identified by a unique SCSI address. SCSI devices can act as initiators or targets.

SCSI port A SCSI port is an opening at the back of a router that provides connection between the SCSI adapter and SCSI bus.

Serial Transmission The transfer of data characters one bit at a time, sequentially, using a single electrical path. See *Parallel Transmission*.

Simple Network Management Protocol (SNMP) SNMP is the Internet standard protocol, defined in STD 15, RFC 1157, developed to manage nodes on an Internet Protocol (IP) network.

small computer system interface (SCSI) SCSI is an industry standard for connecting peripheral devices and their controllers to an initiator. Storage devices are daisy-chained together and connected to a host adapter. The host adapter provides a shared bus that attached peripherals use to pass data to and from the host system. Examples of devices attached to the adapter include disk drives, CD-ROM discs, optical disks, and tape drives. In theory, any SCSI device can be plugged into any SCSI controller.

small form-factor pluggable (SFP) Type of connector.

speed Speed shows the speed of the FC port interface.

Storage Area Network (SAN) SAN refers to the network behind servers that links one or more servers to one or more storage systems. Each storage system could be RAID, tape backup, tape library, CD-ROM library, or JBOD. SANs operate with both SCSI and networking (IP) protocols. Servers and workstations use the FC network for shared access to the same storage device or system. Legacy SCSI systems are interfaced using an FC-to-SCSI bridge.

Storage Manager module The controller module which includes an FC-AL 2Gb/s *LRC I/O module* with integral EF2800 RAID controller.

target A target is a device (peripheral) that responds to an operation requested by an initiator (host system). Although peripherals are generally targets, a peripheral may be required to act temporarily as an initiator for some commands (for example, SCSI EXTENDED COPY command).

terminator block/termination A terminator block (or termination) refers to the electrical connection at each end of a SCSI bus. The terminator block is composed of a set of resistors, or possibly other components. The function of a terminator block is to provide a pull-up for open collector drivers on the bus, and also impedance matching to prevent signal reflections at the ends of the cable. SCSI buses require that a terminator be placed on the 68-pin high-density SCSI connector on the last SCSI peripheral. Data errors may occur in a SCSI bus that is not terminated.

topology A network topology refers to the physical layout of nodes on a network. Topologies range from local network topologies to WAN topologies. FC topologies include point-to-point, FC-AL, and fabric.

trap In the context of SNMP, a trap is an unsolicited message sent by an agent to a management station. The purpose is to notify the management station of some unusual event.

unkill In Active-Active mode, when a surviving controller removes the reset from the other controller, it unkills it. The other controller will reboot and attempt to come online.

write-back cache Memory on the controller that stores data changes until they are written to the disk drives. In most applications, using the controller's write-back cache improves performance and ensures data integrity. Disk drives also have write-back cache, which should be disabled for most applications. Any disk drives with write-back cache enabled should be connected to an Uninterruptible power supply (UPS) in case of a power failure. If the drives are not on a UPS and power is lost during disk writes, the array will lose any data in the disk's write-back cache.

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